Primary Distribution Switchgear

DNF7 - DNF7S

Normafluor

Instructions
Installation - Commissioning - Operation - Maintenance

Schneider Electric

Contents

1 Schneider Electric at your service 1
1.1 Particular instructions for operations and interventions 1
1.2 Protection equipments 1
1.3 Symbols of information 1
1.4 Symbols and important safety informations 1
1.5 Contacts 1

2 With regards to this User Manual 2
2.1 Eco-design concept and valorization of the materials used 2
2.2 Reminder concerning normal service conditions (in accordance with IEC62271-1) 2
* Permissible ambient temperature 2
* Installation altitude 2
* Atmospheric pollution 2
* Permissible atmospheric humidity level 2
2.3 Other technical notices to be consulted 2
2.4 Tightening torque values [Nm] for standard assemblies (nut + bolt) 2
2.5 Tools and products (not supplied) required for the operations described in this notice 3

3 Presentation 4
3.1 Description 4
3.2 Dimensions and weights of the functional units equipped with a circuit-breaker [with packaging] 4
3.3 Dimensions and weights of the functional units with no circuit breaker [with packaging] 4
3.4 Dimensions and weights of the circuit breaker moving parts delivered separately [with packaging] 4
3.5 Presentation of the functional units 5
3.6 ”Bus-riser” functional unit 6

4 Packaging - Handling - Storage 7
4.1 Packaging 7
4.2 Reception 7
4.3 Handling of the functional unit 8
4.4 Unpacking and handling of the high voltage moving part, delivered separately 8
4.5 Storage conditions 9
4.6 Intervention levels 9
4.7 Specific recommendations for storage durations of less than 6 months 10
4.8 Specific recommendations for storage durations of between 6 and 12 months 10
4.9 Specific recommendations for storage durations of between 12 and 24 months 10

5 Unpacking and assembling the equipment 11
5.1 Civil engineering characteristics 11
5.2 Unpacking of the functional units 11
5.3 Handling of the functional unit (without a circuit breaker) 12
5.4 Identification of the functional units and circuit breakers 12
5.5 Installation on the floor 13

6 Installation - Connections 14
6.1 Presentation of the functional units 14
6.2 Installation of each functional unit 14
6.3 Standard case of attachment to the floor 14
6.4 Inter-functional unit earthing circuit connection 15
6.5 Earthing circuit connection, at the far end of the switchboard 15
6.6 Installation of the voltage transformer housing ”busbars” 16
6.7 Connecting the earthing circuit of the busbar voltage transformer housing ... 16
6.8 Connecting the busbar 17
6.9 Preparation of the cable connection 19
6.10 Connecting the cables 20
6.11 Inspections prior to commissioning 21
6.12 Summary of the main list of checks prior to commissioning 21

7 Operation 22
7.1 Operating levers 22
7.2 Opening operation of the earthing switch 22
7.3 Closing operation of the earthing switch 23
7.4 Plugging-in and unplugging operations of the circuit breaker 24
7.5 Unplugging operation of the circuit breaker up to the ”test” position 24
7.6 Complete unplugging operation of the circuit breaker 25
7.7 Plugging-in operation of the circuit breaker 25
7.8 Mechanical device preventing any plugging-in operation 26
7.9 Operatings for the voltage transformer compartment 27

8 Standard locking out and interlocking procedures 28
8.1 Functional mechanical interlocks 28
8.2 Immobilization device of the earthing switch by means of ”locks” 28
8.3 Immobilization device for the earthing switch by means of ”padlocks” (not supplied) 28
8.4 Immobilization device for the plugging-in operation of the moving part 29
8.5 Padlocking of the blanking shutters, by padlock (not supplied) 29
8.6 Additional locking out and interlocking procedures 29

9 Commissioning 30
9.1 Reminder 30
9.2 Inventory of tools and accessories on completion of work 30
9.3 Pre-commissioning information 30
9.4 Final checks before commissioning 30
9.5 Energizing the ”incoming” feeder functional unit 31
9.6 Checking the phase balance 31

10 Maintenance 32
10.1 Levels of maintenance 32
10.2 Preventive maintenance for the circuit breaker moving part 32
10.3 Preventive maintenance of the functional units 32
10.4 Systematic maintenance 33
10.5 Lubrication points in the moving par compartment 34
10.6 Lubrication points in the High voltage cable compartment 34
10.7 Corrective maintenance of the functional units 35
10.8 Replacement of a voltage transformer fuse 35
10.9 Replacement of an internal element (insulator, capacitive divider, etc.) 35
In the ”High Voltage cables” compartment 35
In the ”busbar” compartment 35

11 Spare parts 36
11.1 The spare part 36
11.2 Identification of the equipment (see § 5.4) 36
11.3 Storage conditions 36
11.4 Maintenance Consumables 36

12 End of the equipment service life 37
12.1 Valorization of the equipment 37
12.2 Safety instructions 37
12.3 Dismantling of the equipment 37

13 Notes 38

1 Schneider Electric at your service

© - Schneider Electric - 2011. Schneider Electric, the Schneider Electric logo and their figurative forms are Schneider Electric registered trademarks. The other brand names mentioned within this document, whether they be copyright or not, belong to their respective holders.

Schneider Electric request the carefully reading of the following instructions in order to familiarize yourself with the product in this document before trying to install, operation, put into service or conduct the maintenance on it.

Our products are fully quality controlled and tested at the factory in accordance with the standards and regulations currently in force.

The correct functioning and lifespan of the product depend on respecting the installation, commissioning and exploitation instructions found in this manual. Not respecting these instructions is likely to invalidate any guarantee.

Local safety requirements which are in accordance with these instructions, especially those regarding the safety of product operators and other site workers, must be observed.

Schneider Electric declines any responsibility for the following points:
- the non respect of the recommendations in this manual which make reference to the international regulations in force.
- the non respect of the instructions by the suppliers of cables and connection accessories during installation and fitting operations,
- possible aggressive climatic conditions (humidity, pollution, etc.) acting in the immediate environment of the materials that are neither suitably adapted nor protected for these effects.

1.1 Particular instructions for operations and interventions

This user manual does not list the locking-out procedures that must be applied. The interventions described are carried out on de-energized equipment (in the course of being installed) or locked out (non operational).

Whilst commissioning and operating the product all general safety instructions for electrical applications (protective gloves, insulating stool, etc.) must be respected, this in addition to the standard operating instructions.

All operations must be completed once started.

The durations (for completing the operations mentioned) given in the maintenance tables are purely an indication and depend on on-site conditions.

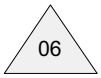
1.2 Protection equipments

Only qualified and accredited people can operate on our products. They must be equipped with all the correct protective equipment required for the task being performed.

A qualified person is one who has the skills and knowledge related to the construction, installation and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.

Except when it is imposed, the wearing of the gloves has been voluntarily limited in this manual so as to have clear visuals of the hands and operations described.

1.3 Symbols of information



Code for a product recommended and marketed by Schneider Electric

Tightening torque value
Example: 21 Nm

Mark corresponding to a key

1.4 Symbols and important safety informations

The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol shall not be used with this signal word.

1.5 Contacts

Group Schneider Electric service centers are there for:

- Engineering and technical assistance
- Commissioning
- Training
- Preventive and corrective maintenance
- Spare parts
- Adaptation work

Schneider Electric Energy France

35 rue Joseph Monier - CS 30323

F-92506 Rueil-Malmaison Cedex

www.schneider-electric.com

2 With regards to this User Manual

2.1 Eco-design concept and valorization of the materials used

The design and manufacture of our packaging are both in conformity with the French government decree N° 98-638 of 20 July 1998, concerning the account that is taken of environmental requirements.

2.2 Reminder concerning normal service conditions (in accordance with IEC62271-1)

* Permissible ambient temperature

The ambient air temperature should be comprised between - 5°C and +40°C.

The mean measured value for a 24 hour period must not exceed 35°C.

* Installation altitude

HV equipment are defined in accordance with European Standards and can be used up to an altitude of 1,000 m.

Beyond this, account must be taken of the decrease in dielectric withstand.

For these specific cases, contact the Schneider Electric Sales Department.

* Atmospheric pollution

The ambient air must not contain any dust particles, fumes or smoke, corrosive or flammable gases, vapours or salts.

* Permissible atmospheric humidity level

The average atmospheric relative humidity level measured over a 24-hour period must not exceed 95%.

The average water vapour pressure over a period of 24 hours must not exceed 22 mbar.

The average atmospheric relative humidity value measured over a period of one month must not exceed 90 %.

The average water vapour pressure over a period of one month must not exceed 18 mbar.

Condensation may appear in case of any sharp variation in temperature, due to excessive ventilation, a high atmospheric humidity level or the presence of hot air. This condensation can be avoided by an appropriate lay-out of the room or of the building (suitably adapted ventilation, air driers, heating etc.).

Whenever the humidity level is higher than 95 %, we recommend that you take appropriate corrective measures. For any assistance or advice, contact the Schneider Electric After-Sales Department. Whenever the humidity level is higher than 75%, we recommend that you take appropriate corrective measures for which Schneider Electric can offer you the necessary assistance.
Please do not hesitate to contact us.

2.3 Other technical notices to be consulted

- AMTNoT023 General lubrification instruction
- AMTNoT017 BLR(M) Control Mechanism — Operation - Maintenance
- AMTNoT055 ORTHOFLUOR FP Circuit Breaker — Installation - Commissioning - Operation - Maintenance

2.4 Tightening torque values [Nm] for standard assemblies (nut + bolt)

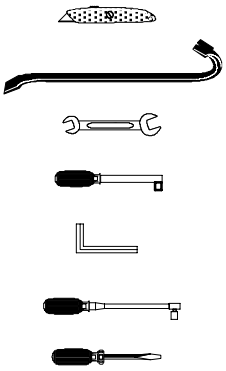
Diameter	Plastic (PA 6.6)	Steel Class < 8.8	Steel Class ≥ 8.8 ≤ 10.9	Threaded fasteners with grease A2-70
M 6	0.8	4.3	8.8	6.6
M 8	1.8	10.5	21.0	15.8
M 10	3.5	14.0	42.0	35.0
M 12	6.0	-	70.0	60.0
M 16	12.0	-	170.0	134.0

2.5 Tools and products *(not supplied)* required for the operations described in this notice

- Cutter
- Crow bar
- Open-ended spanners size 13; 16; 18
- Socket wrenches size 8; 13; 16; 17; 18
- A/F Allen key size 6; 8; 10
- Torque wrench with sockets size 13; 16 and hexagon socket screw size 6; 8; 10
- Flat blade screwdriver
- Rapid tightening pliers
- 4 slings (1000 kg capacity)

- - - - - - - - - - - - - - - - - - - -

- Clean dry cloth
- Solvent (dielectric withstand > 30 kV) excluding chlorinated solvents
- Mechanical grease : Mobilplex 47, Mobilux EP3 by Mobil or Stabilube T6 by Sophos
- Molykote PG 54 grease for electrical contacts by Dow Corning



Product code

–

–

01

07

3 Presentation

3.1 Description

The DNF7 and DNF7S cabinets are made of:
- the front female connector which includes the ”switchgear” compartment (with the withdrawable circuit breaker), running up the low pressure box,
- the rear female connector including, at the top, the ”busbar” compartment and at the bottom the ”cable” compartment.

3.2 Dimensions and weights of the functional units equipped with a circuit-breaker [with packaging]

OPTION

Functional unit	Approximate weight with circuit breaker (kg)	Width (mm)	Height (mm)	Depth (mm)	Depth + gas exhaust duct (mm)
DNF 7S “Incoming” or “Outgoing” feeder	1550	900	2250	2300 (2770 with VT cables)	2500
DNF 7S “Coupling”	1350				none
DNF 7 “Incoming” or “Outgoing” feeder	1650	1300			2500
DNF 7 “Coupling”	1450				none

3.3 Dimensions and weights of the functional units with no circuit breaker [with packaging]

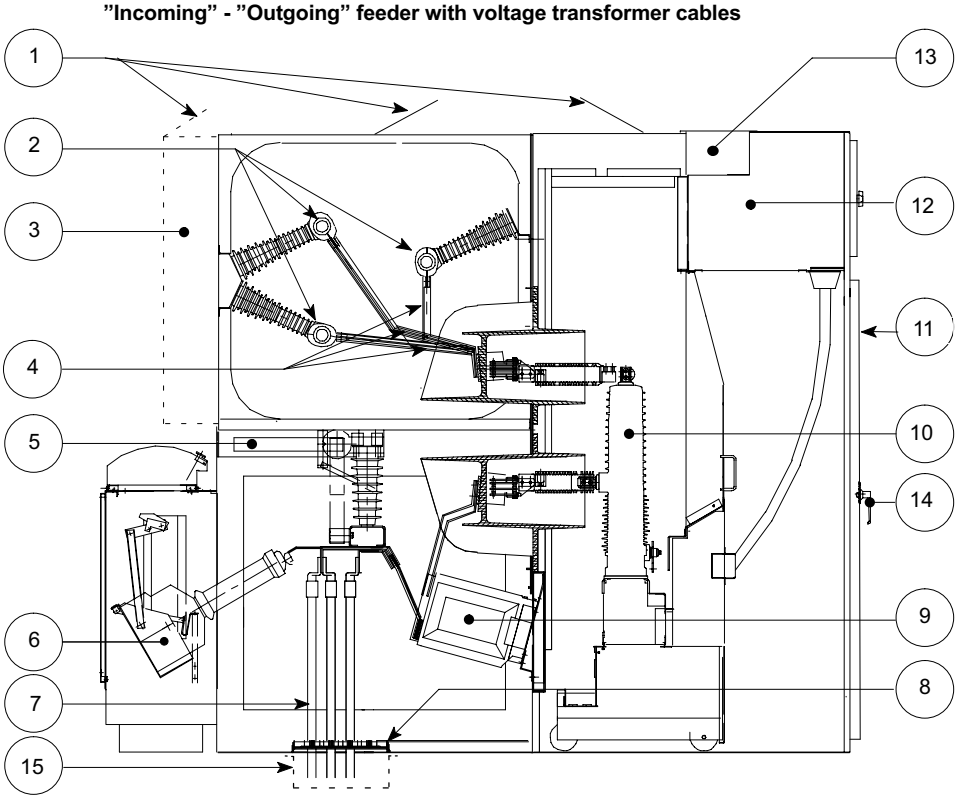
Functional unit	Approximate weight with circuit breaker (kg)	Width (mm)	Height (mm)	Depth (mm)	Depth + gas exhaust duct (mm)
DNF 7S “Bus-riser”	1000	900	2250	2300	none
DNF 7 “Bus-riser”	1100	1300			none

3.4 Dimensions and weights of the circuit breaker moving parts delivered separately [with packaging]

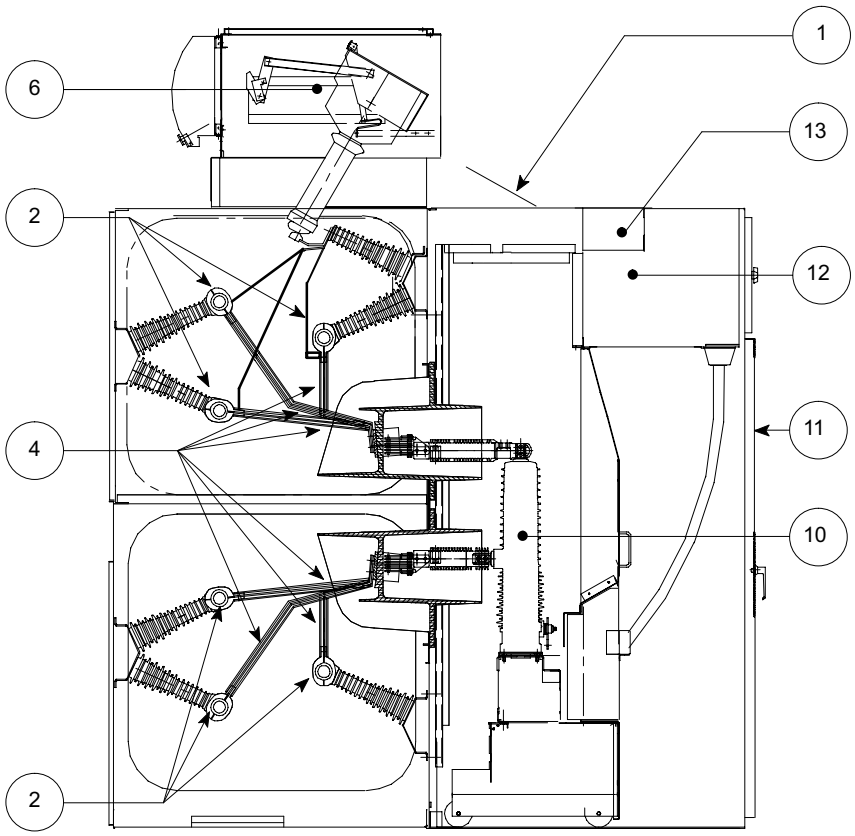
Circuit breaker moving part	Approximate weight (kg)	Width (mm)	Height (mm)	Depth (mm)	-
FP741 [DNF7S]	330	1100	1470	1150	-
FP741 [DNF7]	350	1500	1470	1150	-

3.5 Presentation of the functional units

"Incoming" - "Outgoing" feeder with voltage transformer cables



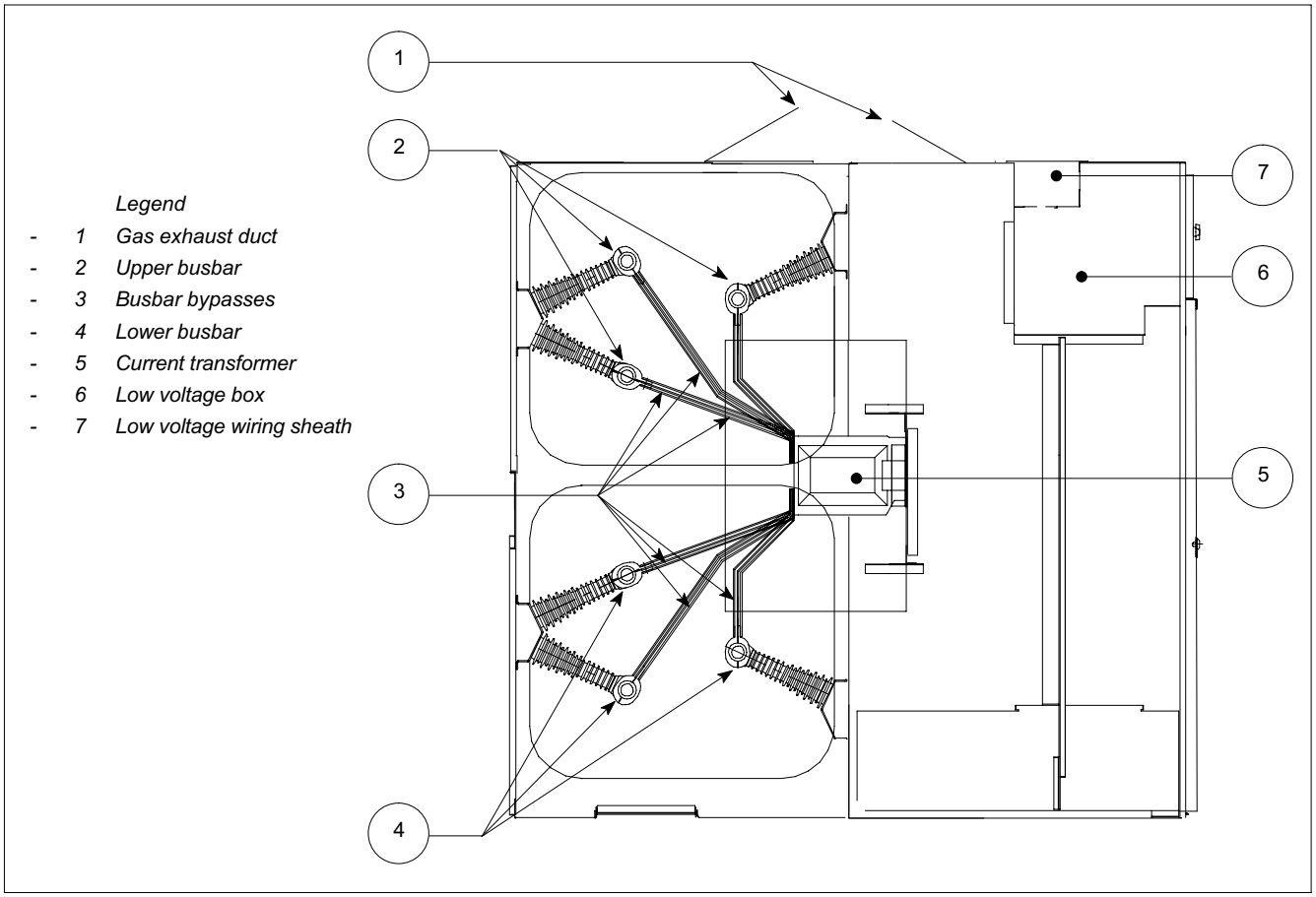
"Coupling" with voltage transformer bars



Legend

- *1 Gas exhaust valves*
- *2 Busbars*
- *3 Gas exhaust duct (internal arc optional feature)*
- *4 Busbar bypasses*
- *5 Earthing switch*
- *6 Voltage transformer compartment*
- *7 Medium voltage cables*
- *8 Cable fastening bottom plates*
- *9 Current transformers*
- *10 FP Orthofluor circuit breaker*
- *11 Access door to circuit breaker compartment*
- *12 Low voltage box*
- *13 Low voltage wiring sheath*
- *14 Handle (internal arc only optional feature)*
- *15 Mounting of the lock cup optional feature + cable fastening bottom plates*

3.6 ”Bus-riser” functional unit

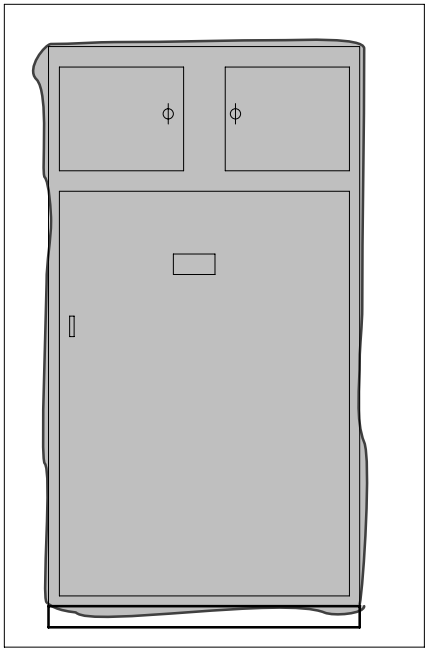


Legend

- *1 Gas exhaust duct*
- *2 Upper busbar*
- *3 Busbar bypasses*
- *4 Lower busbar*
- *5 Current transformer*
- *6 Low voltage box*
- *7 Low voltage wiring sheath*

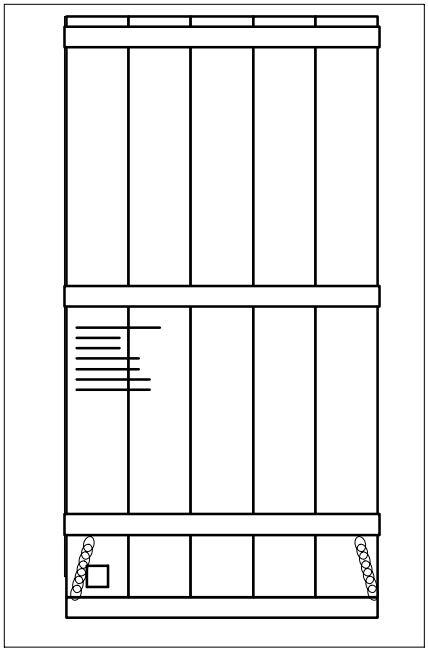
4 Packaging - Handling - Storage

4.1 Packaging



- Packaging for road and rail transport: functional unit on wooden pallets and wrapped under plastic film.

  The accessory packs contain all of the parts necessary for the installation and operation of the switchboard.



- Packaging for air and sea transport: functional unit wrapped under heat sealing film with desiccant bags and placed in wooden crates.
- The moving parts (except the FP741 high voltage parts) are delivered, strapped in each functional unit.

- The FP741 high voltage circuit breakers and the voltage transformer housings are delivered separately on pallets. They are wrapped under plastic film to be sent to a French destination and put in crates to be sent abroad.

4.2 Reception

On reception, ensure that the switchgear is complete.

Carry out a visual examination of the functional units and moving parts.

Check the contents of the accessories pack using the enclosed list.

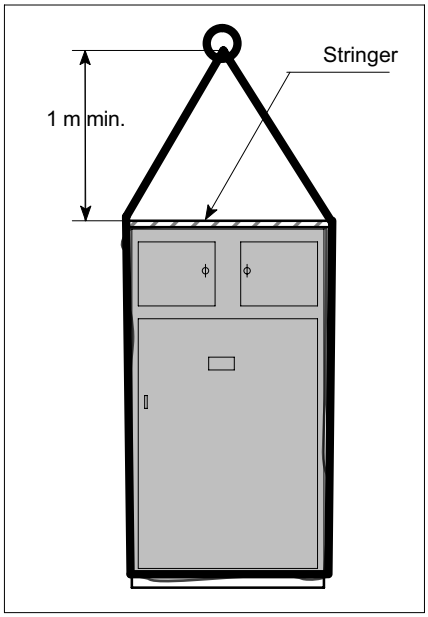
NOTICE

If any anomalies are perceived, please make the necessary reservations with the forwarder.

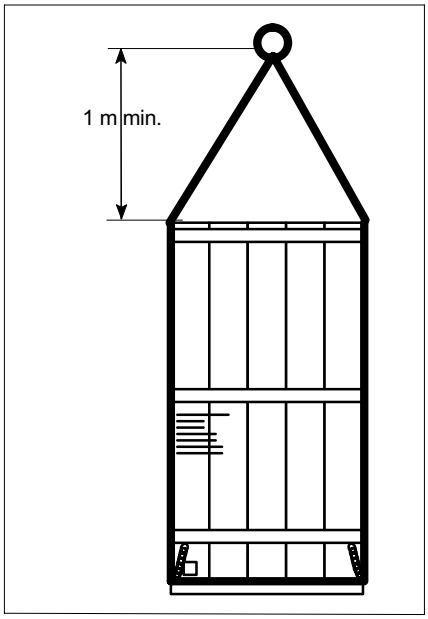
NOTICE

The functional unit must remain on its base and in its original packaging during the storage period and until it is installed.

4.3 Handling of the functional unit



- Packaging for road and rail transport: using 2 slings of **1500 kg each** and a lifting device.
- Place **a protection stringer** between each sling, on the roof of the functional unit.



- Packaging for air and sea transport: using 2 slings of **1500 kg each** and a lifting device.
  Note: the minimum heights given on the diagrams above, must be respected.

- Voltage transformer housings: same type of handling as for the functional units.

4.4 Unpacking and handling of the high voltage moving part, delivered separately

NOTICE

Every circuit breaker is handled in the same way.

CAUTION

A circuit breaker should never be handled by its connectors or its control mechanism.

1 - Remove the roof and sides of the crate (crowbar).

2 - Unscrew the 2 HM12 screws (18 mm spanner).

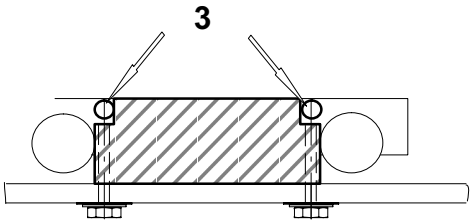
3 - Remove the 2 axles of the housing.

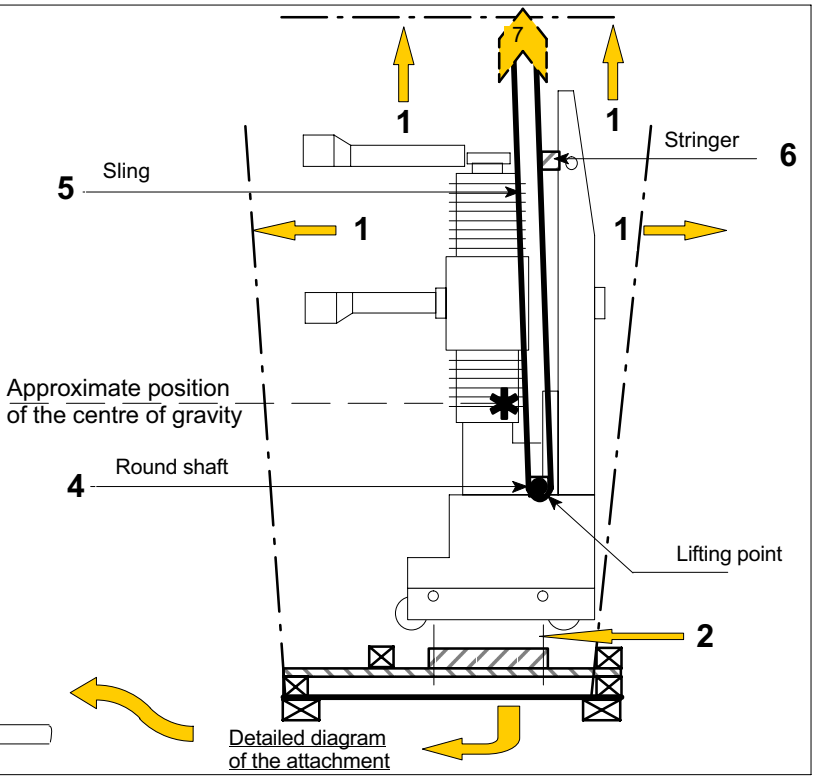
4 - Insert a round steel shaft with a diameter of at least 30 mm, throughout the width of the circuit breaker.

5 - Pass the slings over each end.

6 - Insert a wooden stringer.

7 - Raise it using a lifting device.



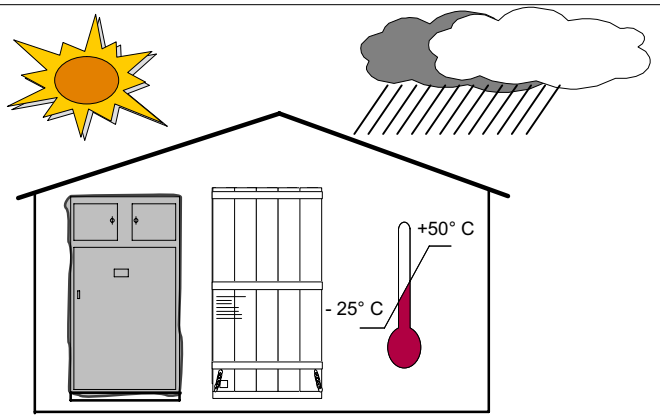


4.5 Storage conditions

The storage area must shelter the equipment from agents likely to cause deterioration such as:

- Water
- Water vapour
- Salt laden air
- Pollution of any type
- Microorganisms

Please consult Schneider Electric in case of non-compliance with these criteria



Make sure the equipment was conditioned in accordance with the requirements of the scheduled storage period.

Avoid storing the equipment in areas submitted to abrupt and drastic changes of temperature.

Make sure no aggressive vapours such as sulphur dioxide (SO_2) for example are given off.

4.6 Intervention levels

Description	Levels
Operations carried out by the Customer	1
Operations requiring specific training, carried out by an approved third party	2
Work to be carried out exclusively by Schneider Electric	3

4.7 Specific recommendations for storage durations of less than 6 months

. Packaged under a plastic covering	1	2	3
Periodically carry out an inspection of the packaging	X	X	X
When unpacking, check the operation of the switchgear by carrying out several operations*	X	X	X

4.8 Specific recommendations for storage durations of between 6 and 12 months

. Protected by a heat-welded sheet, with bags of desiccant	1	2	3
Periodically carry out an inspection of the packaging (check that, among other things, there are no holes)	X	X	X
When unpacking:			
- Check the operation of the switchgear by carrying out several operations*	-	X	X
- Test the min. threshold level (AC, 85% rated Un; DC, 70% of Un) for the electrical operation of the coils	-	X	X

4.9 Specific recommendations for storage durations of between 12 and 24 months

. Protected by a heat-welded sheet, with a method of replacing the bags of desiccant	1	2	3
Periodically carry out an inspection of the packaging (check that, among other things, there are no holes)	X	X	X
Periodically replace the bags of desiccant	X	X	X
When unpacking: - carry out light maintenance work	-	-	X
- Check the mechanical operation of the switchgear by carrying out several operations*	-	-	X
- Test the min. threshold level (AC, 85% rated Un; DC, 70% of Un) for the electrical operation of the coils	-	-	X

⚠ CAUTION

* The pressure of any SF6 circuit breaker having travelled by air must be restored to its rated value before any mechanical operation test.

5 Unpacking and assembling the equipment

5.1 Civil engineering characteristics

The installation of a switchboard requires a sufficiently flat and even concrete structure. The dressing of a top coat of cement using a rule should eliminate any surface irregularities greater than 2 mm per metre.

A layout on iron supports for levelling off is ideal as they will also serve as a guide for the adjustment of the cement top coat.

The overall flatness of the support surface should not show up any deflection greater than 6 mm throughout the length of the switchboard.

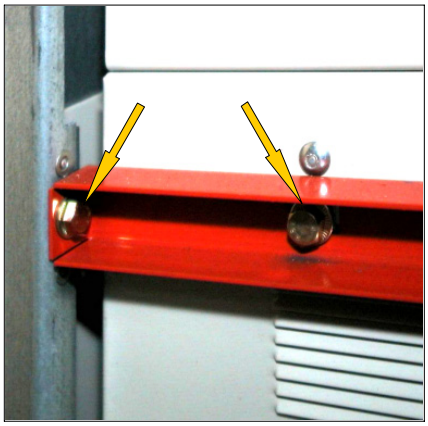
5.2 Unpacking of the functional units

The functional units should only be unpacked on the installation site.

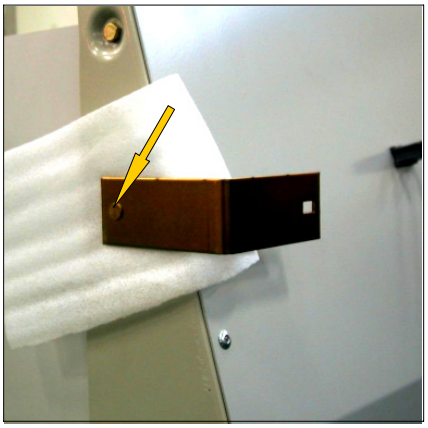
Remove the plastic film or dismantle the front panel and the roof of the crate.

Keep the roof and use it as a ramp when extracting the circuit breaker.

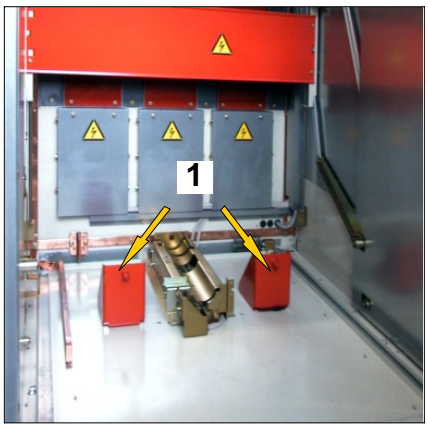
- Open the door of the functional unit.
- Two red bars fasten the circuit breaker.



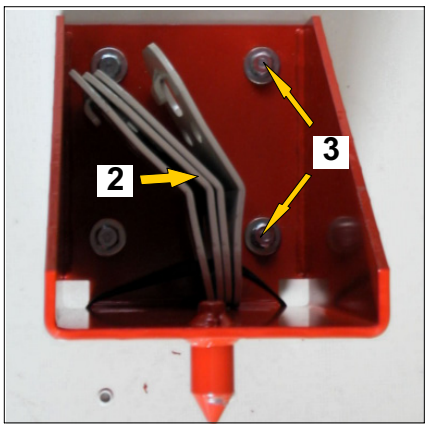
- Remove these two red supporting bars (lower and upper bars) (8 HM8x30 screws, 13 mm spanner).
- Recuperate and place the roof of the crate as a ramp when extracting the circuit breaker.



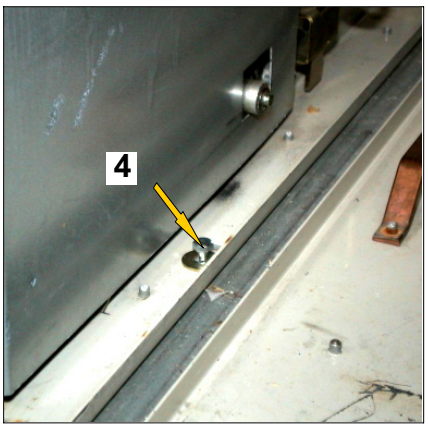
- Extract the circuit breaker (see § 5.7 and 5.9).
- Remove the 2 upper squares of the panel of the moving part.



- 2 red skids are fixed [**1**] on the bottom plate of the front female connector. They are only used to support the moving part during transport.

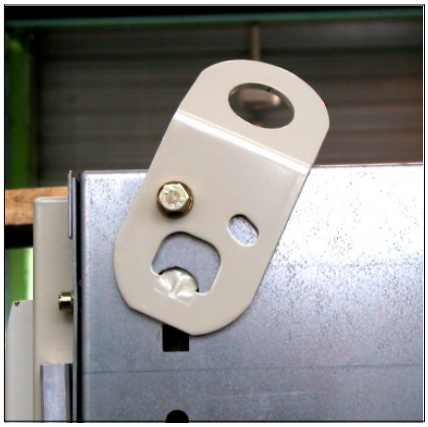


- Remove the 4 lifting squares from one of the skids [**2**] and mount them on the functional unit.
- Remove these two red skids (4 M8 x 60 fixing bolts [**3**]).

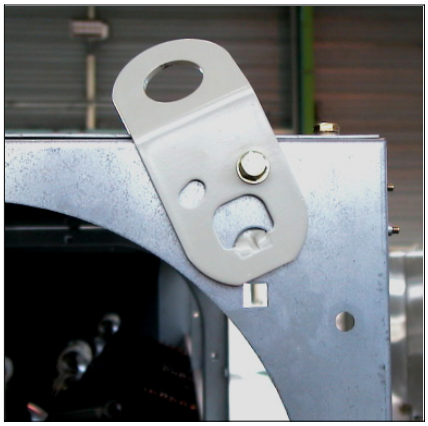


- Dismantle the wooden base (attachment by the inside using 4 M10 x 60 fixing bolts [**4**]: 2 in the front female connector and 2 in the rear lower compartment.

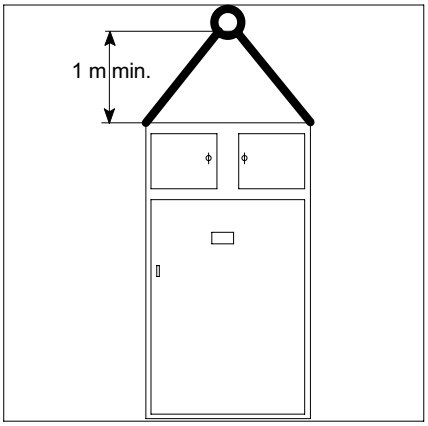
5.3 Handling of the functional unit (without a circuit breaker)



■ Mount 2 squares in the front, upper corners.



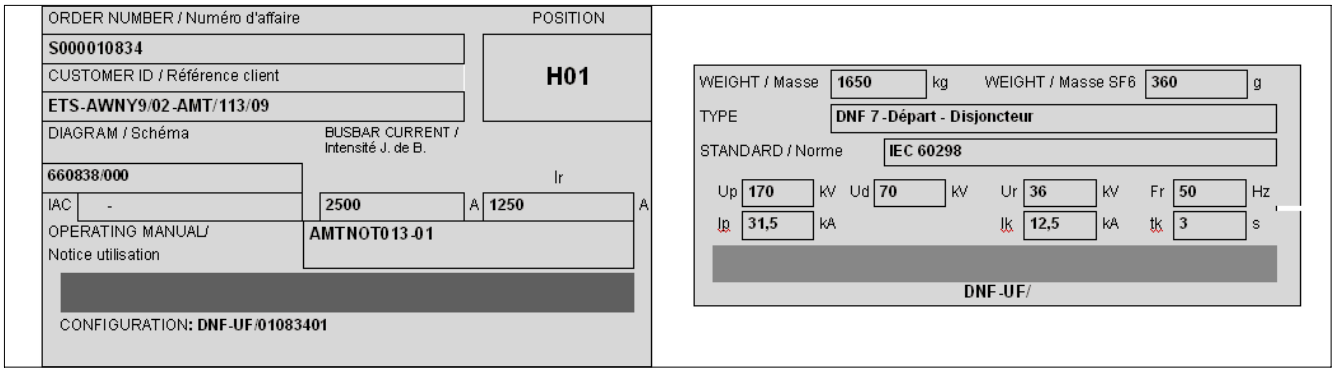
■ Mount the other 2 squares in the rear, upper corners.



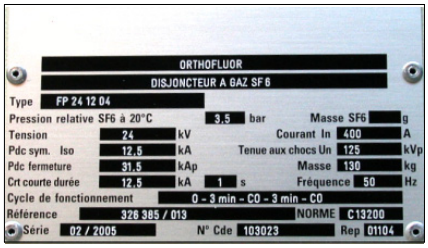
■ Lift the functional unit using 4 slings supporting **1000 kg each**.

5.4 Identification of the functional units and circuit breakers

Check the characteristics given on the Identification and ratings plate in relation to the initial order.



■ Function and technical data plate, located inside CB compartment.

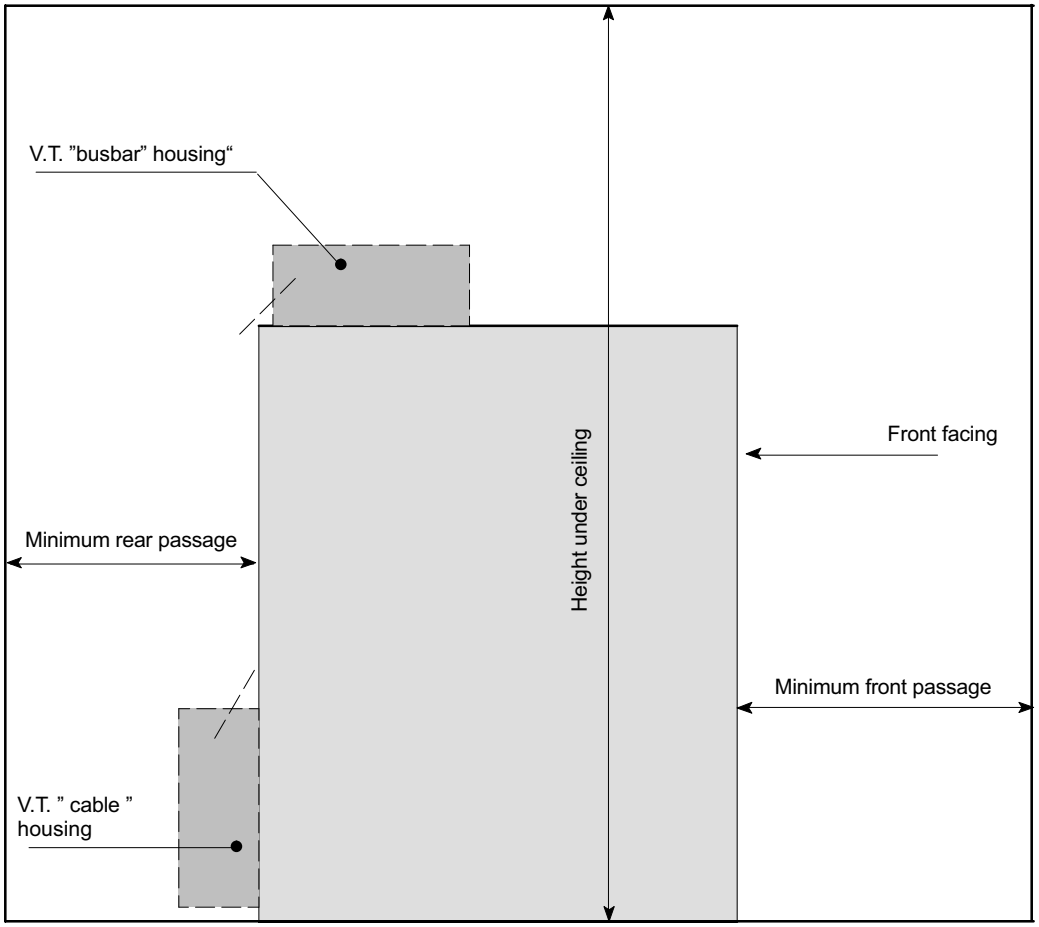

ORTHOFLUOR
DISJONCTEUR A GAZ SF 6
Type FP 24 12 04
Pression relative SF6 à 20°C 3,5 bar
Masse SF6 g
Tension 24 kV
Courant In 400 A
Pdc sym. Iso 12,5 kA
Tenue aux chocs Un 125 kVp
Pdc fermeture 31,5 kAp
Masse 190 kg
Crt courte durée 12,5 kA 1 s
Fréquence 50 Hz
Cycle de fonctionnement 0 - 3 min - CO - 3 min - CO
Référence 326 385 / 013
NORME C13200
Série 02 / 2005
N° Cde 103023
Rep 01104

■ Each circuit breaker is identified by an instruction plate, placed at the rear, on its frame.

5.5 Installation on the floor

The limits of the civil engineering layout depend on the type and quantity of the equipment to install.

Position the panels whilst respecting the minimum distances in the front, at the back and on each side of the switchboard.



Functional unit	Minimum front passage (mm)	Minimum rear (mm)	Minimum rear passage with voltage transformer cables (mm)	Minimum height under ceiling (mm)	Minimum height under ceiling with voltage transformer bars (mm)
DNF 7	1800	800	1500	3000	3500
DNF 7S	1500	800	1500	3000	3500

6 Installation - Connections

6.1 Presentation of the functional units

In the case of a switchboard with 1 to 8 units, its is recommended that the installation of the equipment be begun on the opposite side of the premises access door.

For a switchboard containing more than 8 units, it is recommended that the installation of the equipment be started in the middle of the switchboard.

Sequence the incoming feeder of the functional units in accordance with the single line wiring diagram.

6.2 Installation of each functional unit

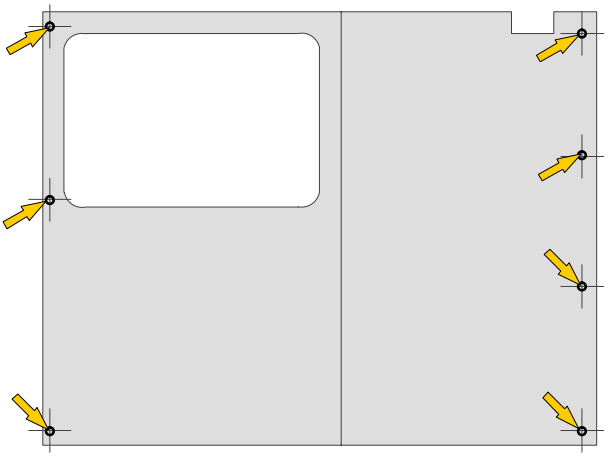
Check that each functional unit is perpendicular to the floor (use wedges if necessary).

Remove the lifting squares (1 square in every top corner, 13 mm spanner).

Check that the circuit breaker can be plugged-in.

Continue to lay out the functional units whilst carrying out the same verifications.

Viewed from the side



Seven coupling points :
- 7 H M10 x 20 screws
- 7 H M10 nuts
- 14 C10 washers (16 mm spanner)

Viewed from the front

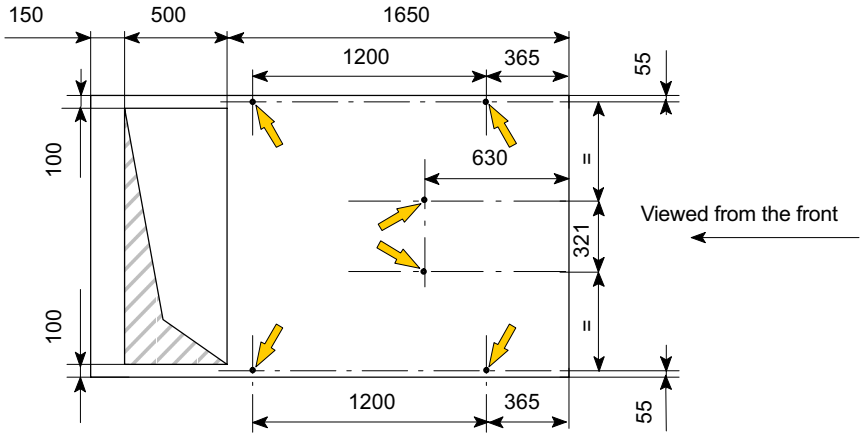
Carry out the coupling of the functional units together (4 points at the front, 3 at the back).

⚠ CAUTION

Do not forget to block up the holes of the lifting squares of the end functional units using the plugs delivered with the accessories. This operation is necessary to preserve the equipment protection index.

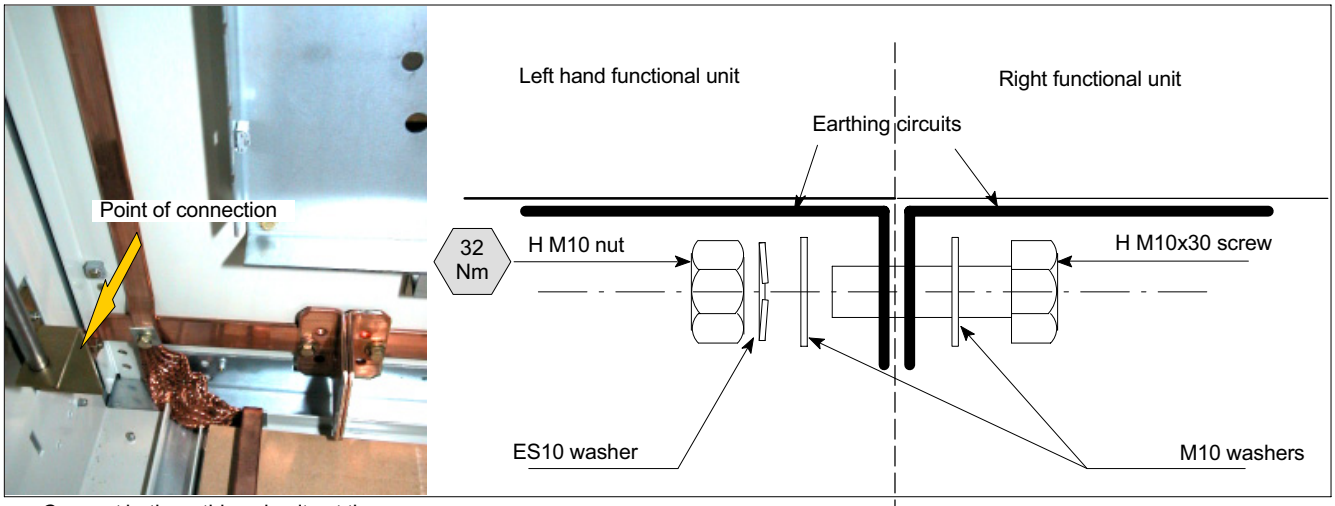
6.3 Standard case of attachment to the floor

6 points of attachment to the floor
(12 mm Ø bolts excluded)



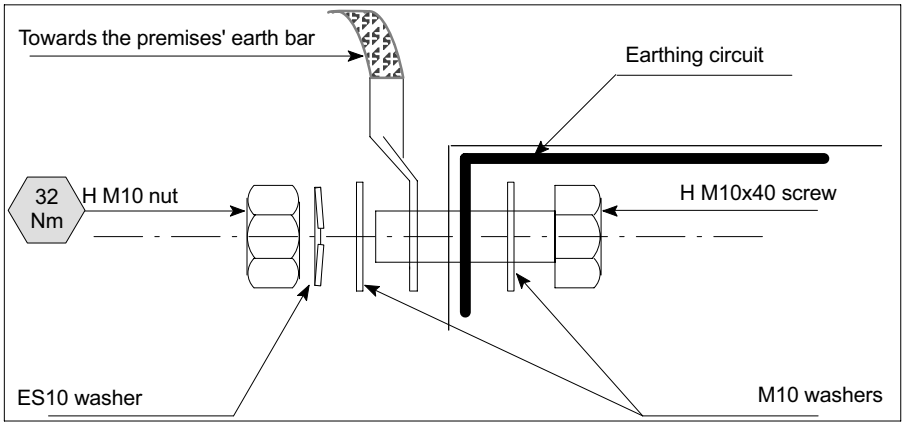
Viewed from the front

6.4 Inter-functional unit earthing circuit connection



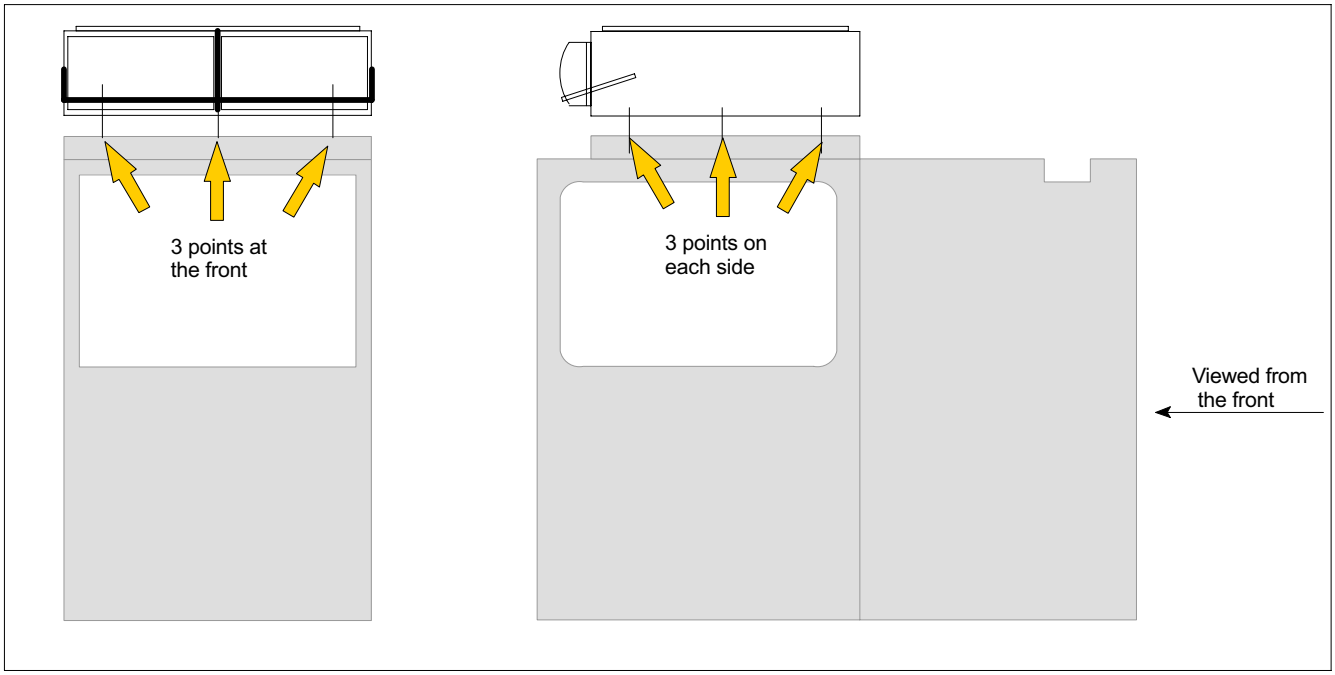
- Connect both earthing circuits at the bottom of the front female connector, on the left and right hand side (17 mm spanner).

6.5 Earthing circuit connection, at the far end of the switchboard



- Connect the earthing circuit of the switchboard to the earthing bar of the premises (17 mm spanner).

6.6 Installation of the voltage transformer housing ”busbars”



The voltage transformer housing ”busbars” is placed on the roof of the functional unit.

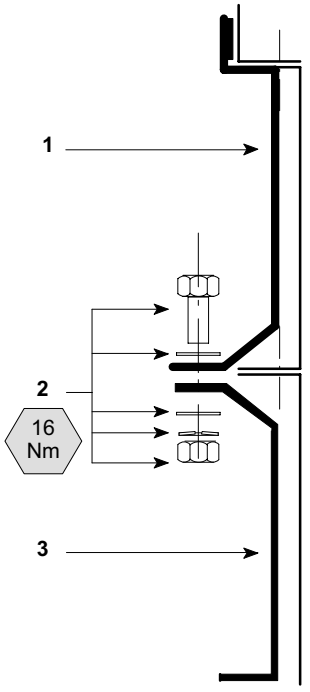
It is fixed by captive nuts and:
- 9 H M8 x 20 screws,
- 9 ES8 extra tightening washers,
- 9 M8 washers (13 mm spanner).

6.7 Connecting the earthing circuit of the busbar voltage transformer housing

1 - Upper earthing circuit

2 - Connection fasteners :
- 1 H M8x16 screw,
- 2 M8 washers,
- 1 extra tightening ES8 washer,
- 1 H M8 bolt (13 mm spanner).

3 - Lower earthing circuit



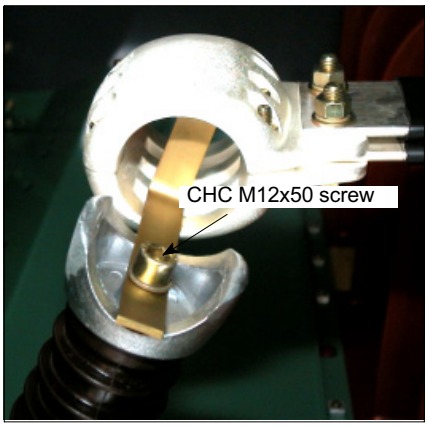
6.8 Connecting the busbar

When connecting the different elements of the busbar:
- respect the mounting directions of all the parts,
- use the screws found in the accessories pack
- use the screw tightening torques recommended by Schneider Electric.

NOTICE

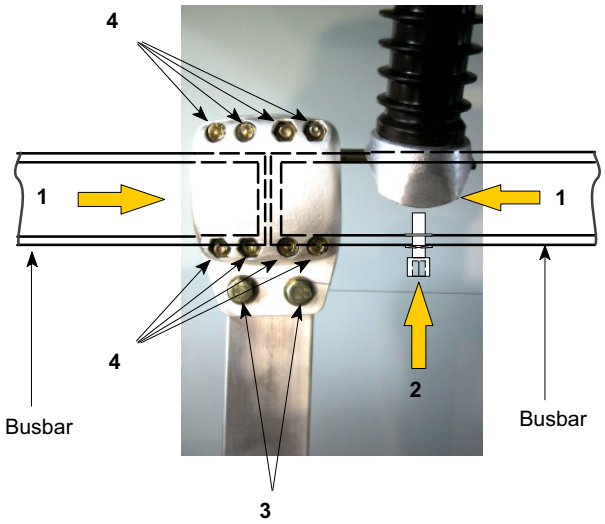
Make sure the contact surfaces are clean. No other preparation is necessary to connect the copper on copper, tinned aluminium on tinned aluminium and tinned aluminium on copper connections.

- Whatever the current, the bypasses are mounted in the factory, the fasteners being in place.
- Remove the rear panel (8 screws, 13 mm spanner).

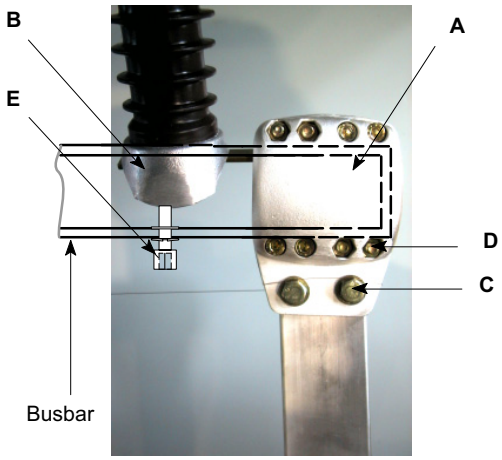


- Remove the part supporting the bypass connection, which ensures the rigidity of the whole switchgear for transport (10 mm A/F Allen key).

- Keep the CHC M12x50 screw, which will be used to fix the bar.
- Assemble the bars in accordance with the diagrams and photos given below.
- The parts [**A**] are mounted and the screws are in place (see diagram opposite).



Mounting of 2 busbars



Mounting of one busbar at the end of the switchboard

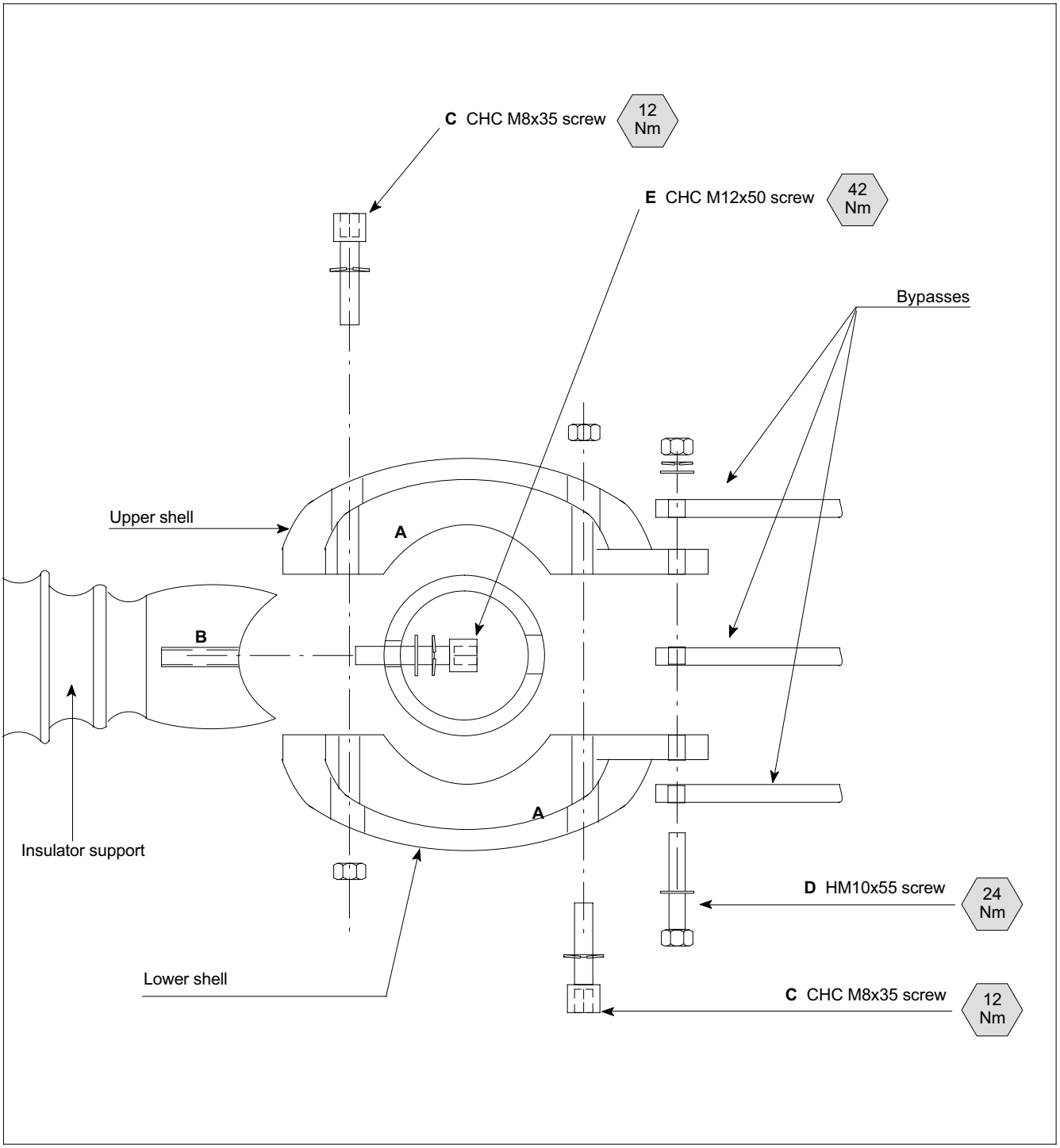
1 - Place the round busbars inside the bypass shells [**A**].

2 - Fix the busbar onto the supporting insulator [**B**], using the CHC M12x50 [**E**] screw (10 mm A/F Allen key).

3 - Tighten the 2 HM10x55 screws (3 busbars) or HM10x45 (2 busbars) [**D**] (16 mm open-ended spanner or socket wrench).

4 - Tighten the 8 CHC M8x35 screws [**C**] (6 mm A/F Allen key).

[Please refer to the diagram opposite.]


C CHC M8x35 screw
12 Nm
E CHC M12x50 screw
42 Nm
Bypasses
Upper shell
A
B
A
Insulator support
D HM10x55 screw
24 Nm
Lower shell
C CHC M8x35 screw
12 Nm

6.9 Preparation of the cable connection

⚠ CAUTION

Schneider Electric can guarantee the contractual characteristics within the limits defined below:
- maximum cross-section: 630 mm^2 with a maximum of 4 cables per phase,
- maximum width of the connection lug: 63 mm.

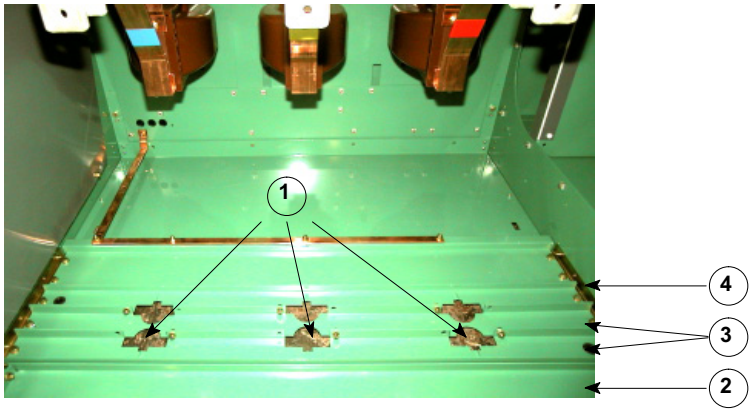
NOTICE

When installing the cables, comply with the connection mounting direction of the lugs, the fastening plates and screws. Use the defined tightening torques (see § 2.4).

The connecting connections must be drilled on the site, depending on the lugs used.

The indications given below are valid to use the lugs in accordance with the current manufacturing standards.

Do not use 500 mm^2 aluminium lugs (6 holes or more).



After having removed the back panel:

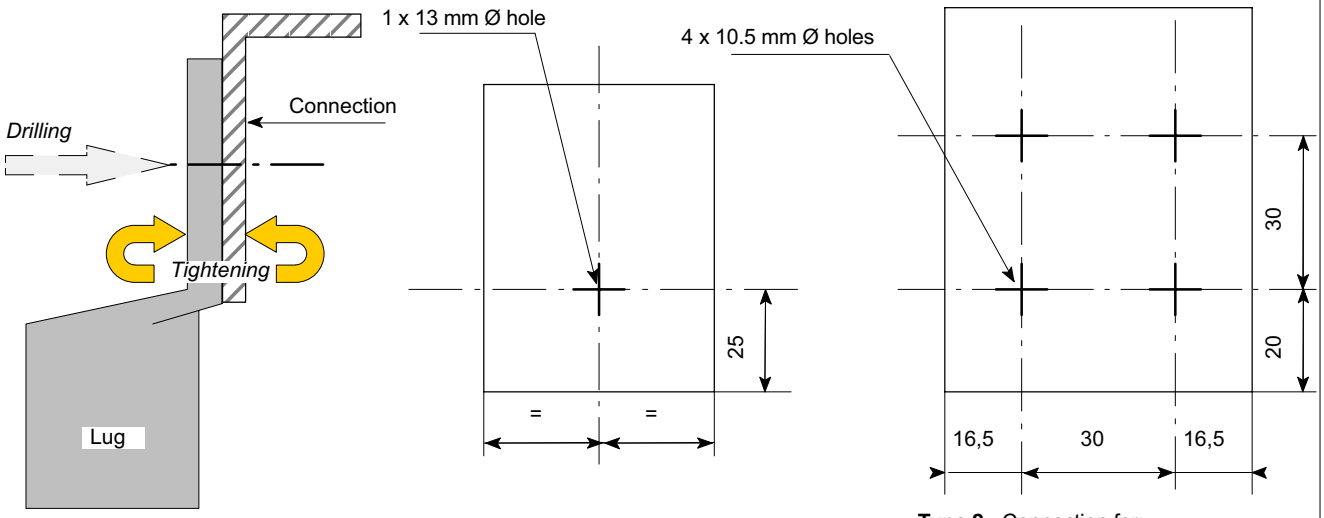
1 - Dismantle every cable tightening strap (13 mm spanner).

2 - Remove the rear crossbeam (4 screws, washers, bolts, 13 mm spanner).

3 - Dismantle the fastening crossbeams (2 screws, washers, 13 mm spanner).

4 - Do not move the last crossbeam.

Examples of positioning

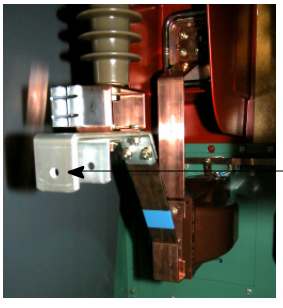


Type 1 - Connection for:
- all types of lugs ≤ 240 mm^2,
- aluminium/copper lugs 300 mm^2 and 400 mm^2

Type 2 - Connection for:
- aluminium/copper lugs, 500 mm^2 and 630 mm^2,
- 300 mm^2 and 400 mm^2 aluminium lugs

NOTICE

In order to obtain a proper drilling:
- dismantle and tighten the connection in a vice (making sure it is protected),
- position and fix the lug onto the connection using rapid tightening pliers,
- point and drill the holes using those of the lug for the centering.



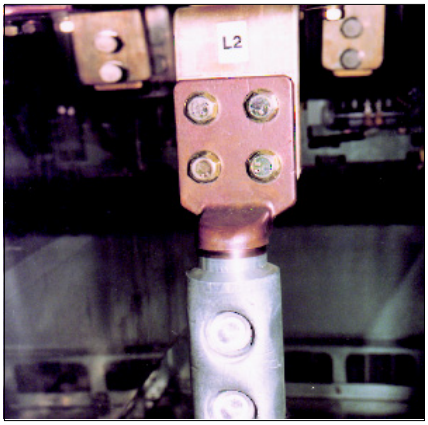
Drilling of a lug connection (**type 1**)

6.10 Connecting the cables

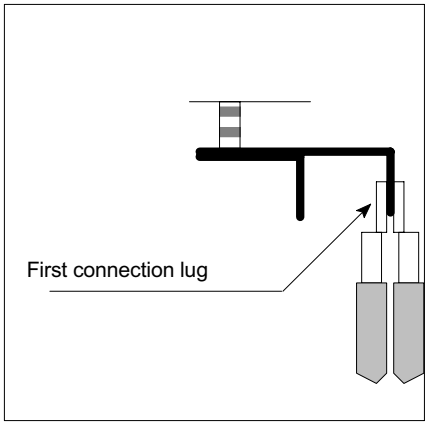
■ Cut the grommet according to the diameter of the cable.

■ Insert onto the cable.

■ It is re-assembled at the end of the cable (installation of the lug) in accordance with the instructions of the supplier regarding the cable ends.



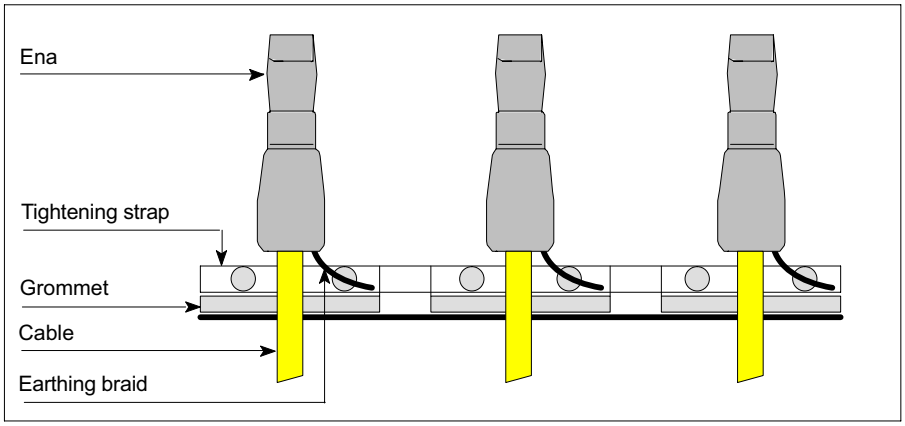
■ Fix each cable onto the connection lug.
- For cables ≤ 400 mm^2, 1 M10 screw, 8.8 class, tightening torque: 32 Nm.
- For cables > 400 mm^2, 4 M8 screws, 8.8 class, tightening torque: 16 Nm.



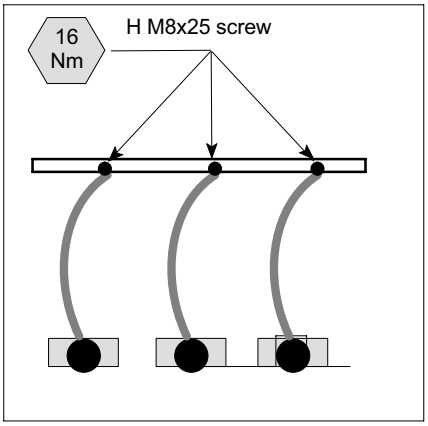
■ To mount 2 cables per phase, connect these 2 cables onto the first connection lug.

NOTICE

Make sure the cable goes through the cable trough, in order to reduce the constraints linked with cable fastening.



■ Carry out the fastening of each cable onto the cable itself.
■ The cable earthing braids must go above the bottom plates.
■ Do not stick the phase marks (coloured adhesive tape) on the re-assemblies.



■ Connect the 3 earthing braids to the earthing circuit (H M8x25 screw, 13 mm spanner).
■ Re-assemble the rear crossbeam.

6.11 Inspections prior to commissioning

Please refer to the drawings and diagrams provided with the equipment and which describe the functionalities performed to carry out every step of the necessary operations.

Record the numbers and identification marks of the equipment and sub-assemblies.

Rigorously observe the locking-out operations and tests under the operating conditions on site.

Respect the general instructions and the site instructions in force.

Check that the premises, the cable duct, the ventilation devices etc. are water-tight.

If the equipment has been kept in a humid area, we recommend that the premises be heated or the heating resistor be supplied power for 24 hours prior to commissioning.

6.12 Summary of the main list of checks prior to commissioning

NOTICE

Inspections and tests have been carried out at the factory.

Details of the checks	Date	Notes	Signature
Visual inspections - Make sure there is no foreign matter inside the switchboard. - Check the outside appearance (no trace of shocks, no scratches on the paint. Carry out the necessary touch-ups. - Check that the equipment complies with the safety index (leaktightness of the functional units, different obstructions, etc.).			
Mechanical inspections - Operation and interlock tests of the access doors and moving panels. - Tests carried out on the interlock system by means of locks. - Inspection of the mechanical tightening systems (electrical jointings, power and earthing circuits, etc.).			
Operational manoeuvres of the moving parts - Plugging-in and unplugging operations. - LV plug connection. - Arming, closing, tripping.			
Dielectric tests - Whilst taking all the necessary precautions, carry out a dielectric test of the HV equipment and LV wiring. Note: These tests are to be carried out before the electrical tests.			
Electrical tests - Verification of the earthing circuit continuity. - Checking the connections of the LV links. - Operational test of all of the LV equipment. - Recording of the relay parameter settings after having checked that the switchboard is operating correctly.			

7 Operation

7.1 Operating levers

■ Earthing switch.

■ Circuit breaker moving part.

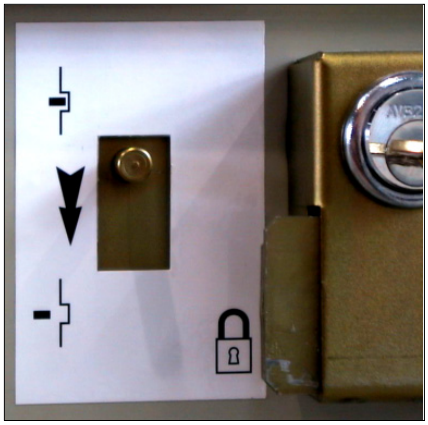
■ Circuit breaker rearming lever.

7.2 Opening operation of the earthing switch

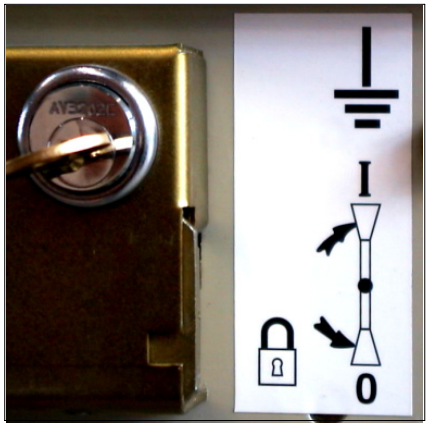
⚠ CAUTION

Never use the operating lever without having previously pushed in the unlocking lever.

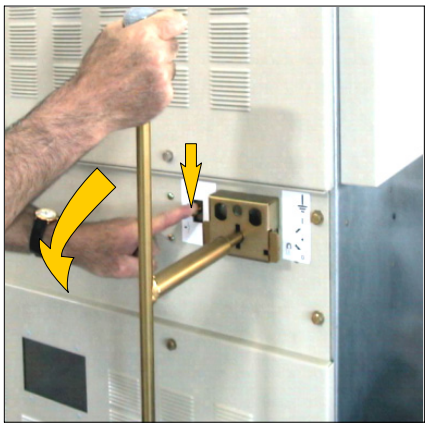
■ Insert the lever in the vertical position, handle in the high position.



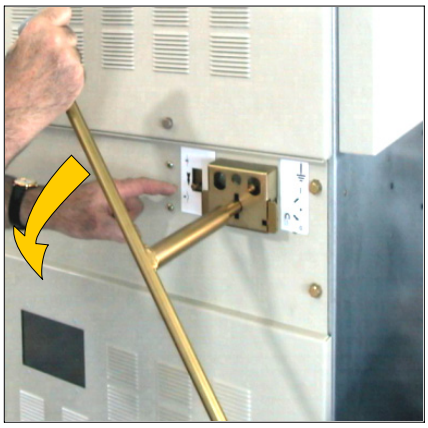
■ Unlocking lever placed on the left of the control mechanism box of the earthing switch.



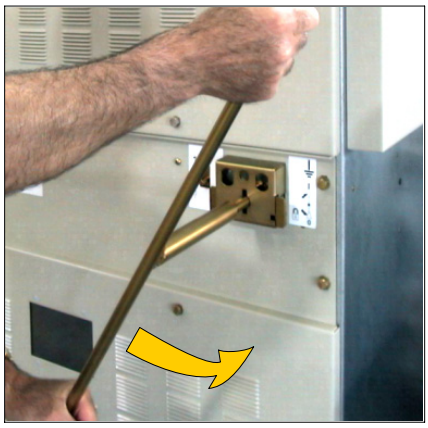
■ Indications on the direction of the earthing switch operation.



- Using your left hand, push the unlocking lever down.
- Using your right hand, hold the operating lever by the handle and swing it to the left.

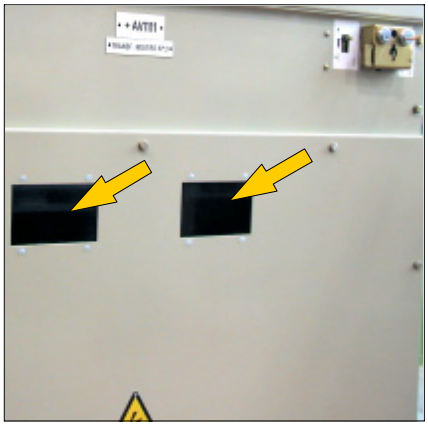


- Unlocking lever placed on the left of the control mechanism box of the earthing switch.



- Indications on the direction of the earthing switch operation.

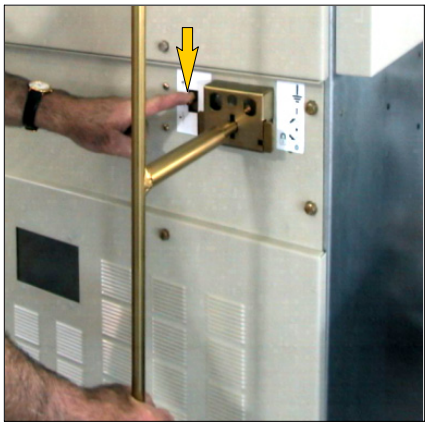
- At the end of the operation, the unlocking lever returns to its original position.
- The earthing switch is open.



- Check the physical position of the earthing switch using the 2 inspection windows of the rear panel.

- When there is no earthing switch, the back panel has no inspection window.

7.3 Closing operation of the earthing switch

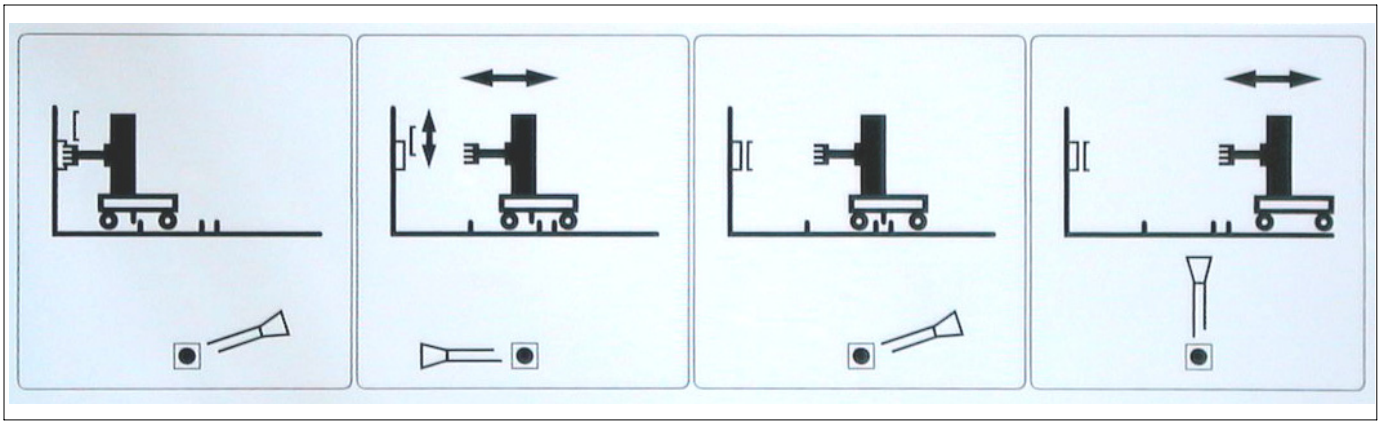


- Insert the lever in the vertical position, handleat the bottom.
- Using your left hand, push the unlocking lever down.
- Using your right hand, hold the lever by the handle and push it up to the left.

- Release the unlocking lever, which remains in the same position.
- Hold the lever using both your hands in order to finish the closing operation of the earthing switch.

- At the end of the operation, the unlocking lever returns its original position.
- The earthing switch is closed.
- Check its physical position through both inspection windows of the rear panel.

7.4 Plugging-in and unplugging operations of the circuit breaker

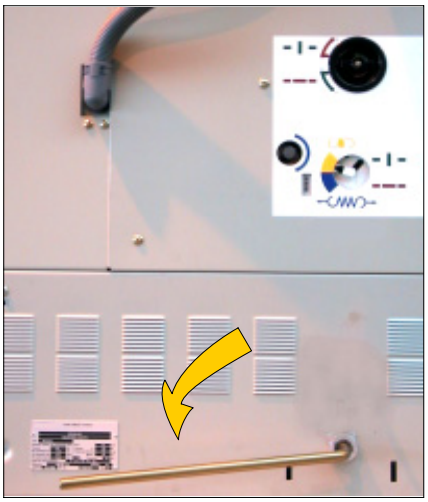


■ Instruction plate at the front of the circuit breaker.

7.5 Unplugging operation of the circuit breaker up to the ”test” position

■ Open the door of the circuit breaker compartment.
■ Make sure the circuit breaker is released.

■ Insert the operating lever in the operation position on the right.



■ Swing the lever from the right to the left, which unlocks the circuit breaker from its ”plugged-in” position.

■ The circuit breaker can then be tested at no load.

■ The unplugging operation automatically generates :
- the release of the circuit breaker, in case this had been omitted,
- the obstruction of the plugging-in plugs by means of metal shutters.

■ Pull the circuit breaker until it reaches the ”test” position, using both side handles.

■ Lock the circuit breaker whilst swinging the lever to the right.

7.6 Complete unplugging operation of the circuit breaker

- Make sure the re-arming motor is not in an operating cycle.
- Note: The locking of the low voltage plug is optional.

- Press the unlocking lever of the low voltage plug.

- Maintain the lever.
- Turn the knurled button.
- Unplug the socket.

- Clip the low voltage socket onto its support.

- Swing the lever into the vertical position, which unlocks the circuit breaker from its ”test” position.

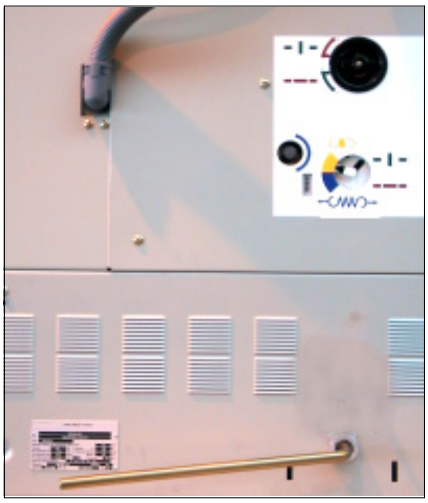
- Extract the circuit breaker from its compartment by pulling it using both side handles.

7.7 Plugging-in operation of the circuit breaker

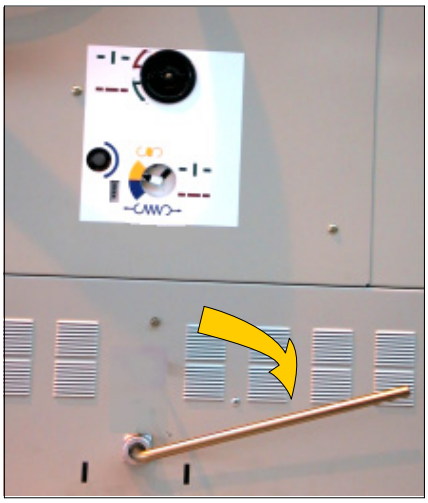
- The circuit breaker must be in the ”open” position.
- Insert the operating lever into the vertical position.

- Push the circuit breaker until it reaches the ”test” position.
- Swing the lever to the left.

- Before plugging-in and screwing in the low voltage plug: - manually arm the mechanical control mechanism,
  - cut the LV circuits.



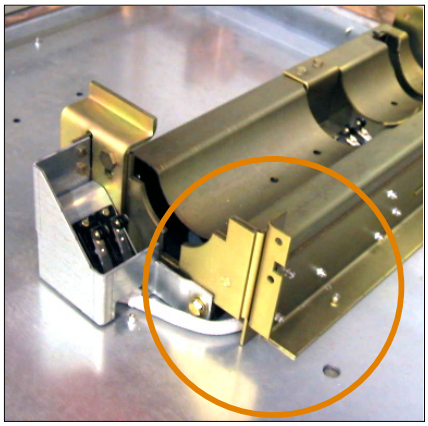
- Push the circuit breaker (lever always on the left) until it reaches the end stop.



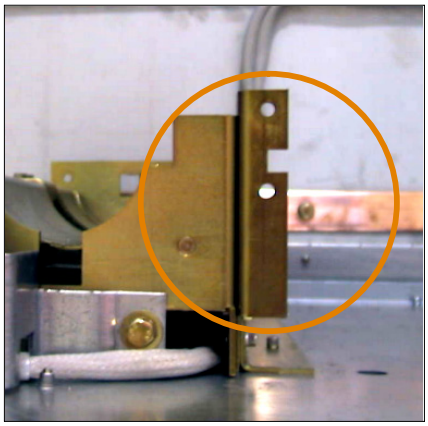
- Circuit breaker at its end stop: swing the lever to the right (locking in the plugged-in position).

- Remove the lever.
- Close the door.
- The circuit breaker is ready to be operated.

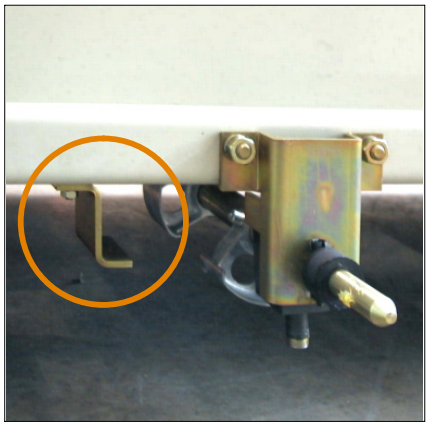
7.8 Mechanical device preventing any plugging-in operation



- Every functional unit is equipped with a ”mechanical” fool-proof system preventing the plugging-in operation of an incompatible moving part.



- Never change the altitude or remove the fool-proof device from the functional unit.



- Never dismantle the fool-proof bracket placed under the moving part.

⚠ WARNING

Do not force the introduction of the moving part into the front female connector.

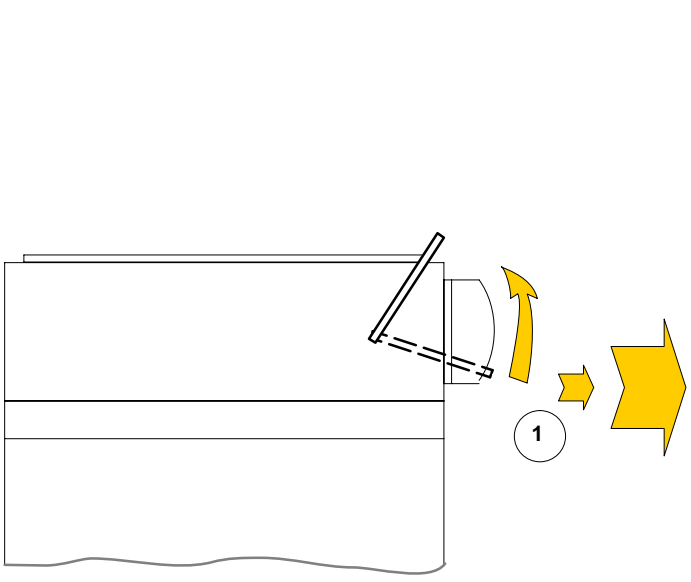
NOTICE

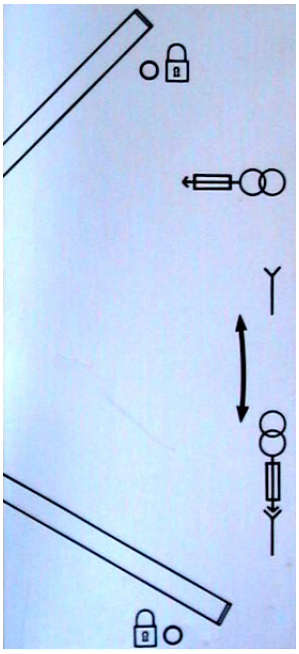
Check the matching of the moving part current with the type and rating of the functional unit.

NOTICE

If necessary, you are allowed to insert a 1250 or 2000 A “circuit-breaker” moving part into a 630 A functional unit.

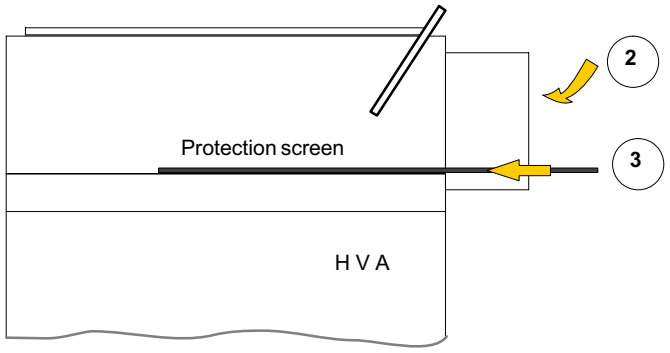
7.9 Operatings for the voltage transformer compartment

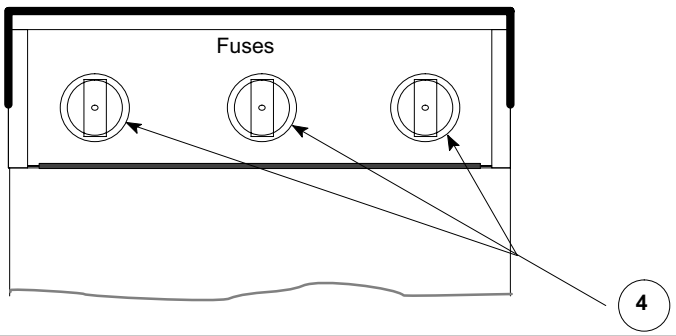




Lever up: unplugged transformers.

Lever down: plugged-in transformers.





In order to access the fuses or the secondary circuit devices of the voltage transformers:

1 - Operate the control ramp from the bottom to the top, which leads to:
- Switching of all of the voltage transformers/fuses,
- Breaking of the MV current,
- Disconnection of the low voltage circuit.

Note : During the transformer opening or closing operations, ***accompany the control ramp until the end of the operation.***

2 - Open the doors giving access to the voltage transformers and fuses.

3 - Insert the protection screen (red) in its housing, which ensures the physical separation from the energized parts.

4 - Then, access the fuses.

8 Standard locking out and interlocking procedures

8.1 Functional mechanical interlocks

DNF7-DNF7S Functional Units are equipped with mechanical interlocks, called ”functional”, intended to avoid any kind of operating error.

8.2 Immobilization device of the earthing switch by means of ”locks”

■ Earthing switch open.

■ Earthing switch closed.

8.3 Immobilization device for the earthing switch by means of ”padlocks” *(not supplied)*

NOTICE

The passage holes are foreseen for padlock shackles of ∅ 8 mm.

NOTICE

The fitting of several padlocks on a single point necessitates the use of an accessory that is not supplied.

■ Earthing switch open.

■ Earthing switch closed.

8.4 Immobilization device for the plugging-in operation of the moving part

The immobilization of the plugging-in operation of the ”circuit breaker” moving part can be carried out by means of padlocks or locks.

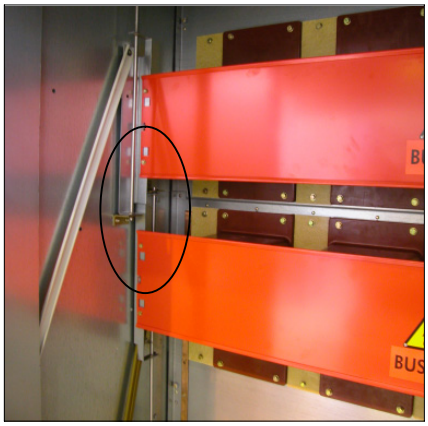
Before any plugging-in operation of the circuit breaker, make sure the earthing switch is open (see § 7.2).

NOTICE

Before any operation of the earthing switch, make sure that:
- the moving part is in the ”test” position (see § 7.5) or extracted from the compartment,
- there is no voltage on the voltage presence boxes.

8.5 Padlocking of the blanking shutters, by padlock *(not supplied)*

The circuit breaker must be withdrawn and extract from its compartment (see § 7.6).



■ Circuit breaker withdrawn: location intended for fitting the padlocks.

■ Locking out by padlock *(not supplied)*.

■ Locking out by padlock *(not supplied)*.

⚠ WARNING

NEVER ATTEMPT TO LIFT UP OR DISMANTLE THE BLANKING SHUTTERS!

8.6 Additional locking out and interlocking procedures

Other locking-out and additional locking devices can be supplied depending on the particular specifications of the contract.

9 Commissioning

9.1 Reminder

Prior to shipping, DNF7-DNF7S Functional Units are mechanically and electrically tested.

If the equipment has been stored in a damp location, it is recommended that the room be heated and the heating elements be energized for a period of 24 hours prior to installation of the switchboard.

Also check the leaktight sealing in the room and the cable troughs.

9.2 Inventory of tools and accessories on completion of work

Recover, verify and tidy away all assembly tools and objects not required in the switchboard.

Return the Functional Unit's and Circuit Breakers' operating accessories to their respective storage positions.

Attach the DNF7-DNF7S technical instruction manual in a visible location within the room.

9.3 Pre-commissioning information

Respect the General Safety Instructions booklet for Electrical Applications and the particular regulations for the network concerned with regard to locking-out procedures.

Record the serial numbers and identifying marks on equipment and switchgear while they are accessible. Tests and inspections have already been carried out in the factory.

Refer to the drawings and diagrams supplied with the equipment. They describe the functionalities employed to carry out the level of operation required.

9.4 Final checks before commissioning

Visual inspection	Date	Remarks	Signature
- Ensure there are no foreign bodies inside the switchboard. - Check the external appearance (for absence of blows, scratches on the paint): carry out touch-ups if necessary. - Check the conformity with the Protection Index (leaktightness of the Functional Units, various blanking panels, etc.).			

”Mechanical” checks	Date	Remarks	Signature
- Operating and interlocking tests on the access doors and removable panels. - Key-locked system tests. - Inspection of mechanical tightening torques (electrical jointing, power and earthing circuits, etc.).			
Handling operations carried out on the switchgear: - Closing and opening the load break switches and earthing switches, - Arming, closing and tripping the circuit breakers.			

Inspections and tests	Date	Remarks	Signature
Dielectric tests (at 80% of the test value) - Whilst taking all necessary precautions, carry out a dielectric test on the HV equipment and LV cabling. NB: These tests must be carried out prior to electrical testing.			
Electrical tests - Check the continuity of the earthing circuit. - Check the connections on the LV links. - Test the correct functioning of the LV switchgear. - Record the relay parameters.			

State of the switchgear	Date	Remarks	Signature
- Ensure that all the load break switches, circuit breakers and earthing switches are open and the access panels to the cables and the busbars are in place. - In accordance with the fuse supplier instructions, ensure that the striker covers on the voltage transformer fuses have been removed.			

9.5 Energizing the ”incoming” feeder functional unit

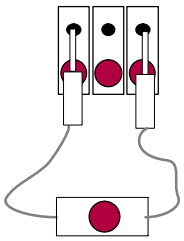
- Energize the cables.
- Check that the neon lamps of the voltage presence box light up.
- Energize the busbar. In order to do so, plug in, lock and close the circuit breaker (see § 7.5).

Case of 2 ”incoming” feeder functional units

- Energize the cables.
- Check that the neon lamps of the voltage presence box light up.
- Check the phase balance (see § 9.6).

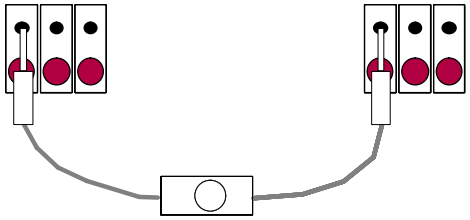
9.6 Checking the phase balance

1 - Testing the phase comparator



- Connect both plugs of the phase comparator *(optional)* to 2 phases of the same functional unit.
- The lamp should light up : the comparator is in operation.

2 - Checking the phase balance



- Phases balanced : lamp off
- Phases unbalanced : lamp on.

- Make sure the phases are balanced using the already checked removable device.
  If there are out-of-phase, check the cable connections.

10.1 Levels of maintenance

Description	Levels
Operations recommended in the instructions manual "installation - operation - maintenance", carried out by suitably qualified personnel having received training allowing them to intervene whilst respecting the safety rules.	**1**
Complex operations, requiring specific expertise and the implementation of support equipment in accordance with Schneider Electric's procedures. These are carried out by Schneider Electric or by a specialised technician, trained by Schneider Electric in the implementation of procedures, and who is equipped with specific equipment.	**2**
All preventive and corrective maintenance, all renovation and reconstruction work is carried out by Schneider Electric.	**3**

10.2 Preventive maintenance for the circuit breaker moving part

Please refer to the specific instruction manuals (See § 2.3).

PREVENTIVE MAINTENANCE	Frequency		Levels		
Recommended operations	3 years	6 years	1	2	3
Removal of dust from the insulating enclosure of the poles (clean, dry cloth)	-	X	X	X	X
Checking the state of the plugging in clips	-	X	-	-	X
Checking the earthing device on the moving part (clips and contact jaws)	-	X	-	-	X

10.3 Preventive maintenance of the functional units

PREVENTIVE MAINTENANCE	Frequency		Levels		
Operations recommended at the Functional Unit level	3 years	6 years	1	2	3
Verification of the presence and condition of accessories (levers, etc.)	X	-	X	X	X
Visual inspection of the exterior (cleanliness, absence of oxidation, etc.)	X	-	X	X	X
Cleaning of external elements, with a clean, dry cloth	X	-	X	X	X
Checking the tightness to torque (covers, wiring ducts, connections, etc.)	X	-	X	X	X
Checking the mechanical controls by carrying out a few operations	X	-	X	X	X
Checking the positioning of the status indicators (armed, open and closed)	X	-	X	X	X
Control of the status and functioning of locking by key locks	X	-	X	X	X
Dusting and cleaning the internal mechanical elements (without solvent)	X	-	-	X	X
Inspection of the tightening of the threaded fasteners and presence of internal stop elements	-	X	-	-	X
Dusting and cleaning the internal mechanical elements (with solvent)	-	X	-	-	X
Lubrication and greasing of mechanical elements (with recommended products)	-	X	-	-	X
Monitoring the general appearance of the mechanical components and connections	-	X	-	-	X
Testing the "function" mechanical interlocks	-	X	-	-	X

PREVENTIVE MAINTENANCE	Frequency (years)		Levels		
Operations specific to the "circuit breaker compartment" moving part	3	6	1	2	3
Ensure that the shutters function correctly (plugging in/unplugging)	-	X	-	X	X
Checking the state of the plugging in electrodes	-	X	-	-	X
Cleaning the insulating components with a clean dry cloth	-	X	-	-	X
Cleaning and lubrication of the mechanical parts [see § 10.5 & 10.6]	-	X	-	-	X
Examining the high power electrical contacts	-	X	-	-	X
Checking for the absence of overheating or discharges in the plugging in electrodes	-	X	-	-	X
Operations specific to the "busbar" compartment	3	6	1	2	3
Checking of the tightening torque on the busbars	-	X	-	X	X
Cleaning of the internal elements (insulators, connections, base supports etc.)	-	X	-	X	X
Checking of the leaktightness of the compartment	-	X	-	-	X
Visual inspection of the appearance of the internal components	-	X	-	-	X
Operations specific to the "high voltage cables" compartment	3	6	1	2	3
Cleaning of the internal elements (insulators, connections, supports, etc.)	-	X	-	X	X
Checking of the state of the earthing switch contacts	-	X	-	-	X
Checking of the leaktightness of the compartment	-	X	-	-	X
Examination of the state of the cable re-assemblies	-	X	-	-	X
Cleaning and lubrication of the mechanical parts [see § 10.5 & 10.6]	-	X	-	-	X
Visual inspection of the appearance of the internal components	-	X	-	-	X
Operations specific to the "voltage transformer" compartment	3	6	1	2	3
Verification of the state of the internal components	-	X	-	-	X
Verification of the tightening torque of the screws and presence of stop elements	-	X	-	-	X
Visual inspection of the contact surfaces	-	X	-	-	X
Inspection and cleaning of the contact surfaces on the HV fuses	-	X	-	-	X
Operations specific to the low voltage box	3	6	1	2	3
Checking of the state of the internal components	-	X	-	X	X
Checking the tightening of the terminals and the electrical connections in general	-	X	-	X	X
Examination of the general state of the wiring and the relays	-	X	-	X	X

10.4 Systematic maintenance

A systematic check of every point of tightening of the high voltage connections may be required.

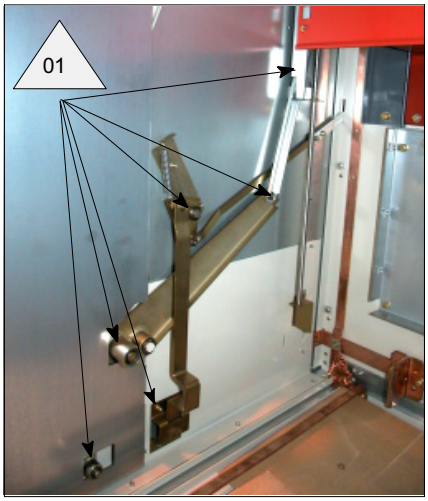
Every 3 operations, all of the fasteners must be changed.

NOTICE

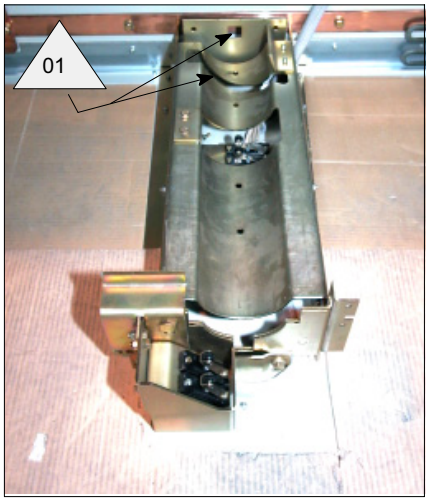
In some cases, screws need lubrication (please refer to the assembly plans).

10.5 Lubrication points in the moving par compartment

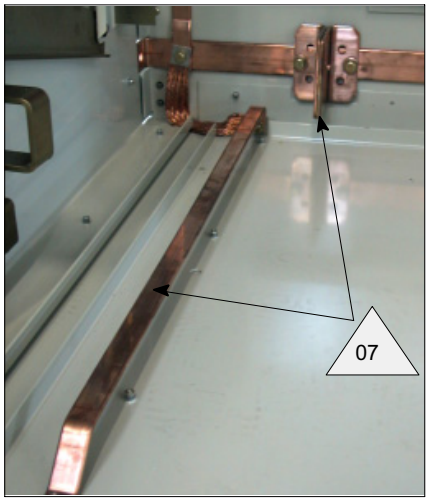
Apply the ”General Safety Instructions booklet for Electrical Applications” and the particular recommendations for the network concerned for locking-out operations.	Greases: (see § 2.5)	Duration: 1 hour per functional unit



■ Lubrication of the guide sliding joints of the shutters, joints of the tie-rods and rollers.



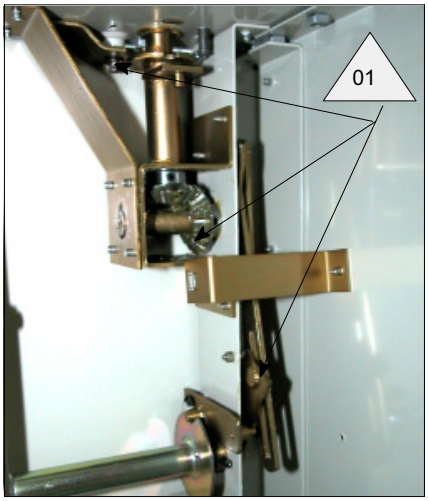
■ Plugging-in ramp.



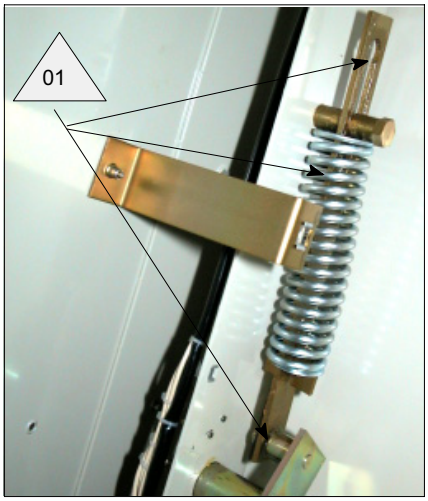
■ Earthing shoe and plugging-in block of the circuit breaker's earthing circuit.

10.6 Lubrication points in the High voltage cable compartment

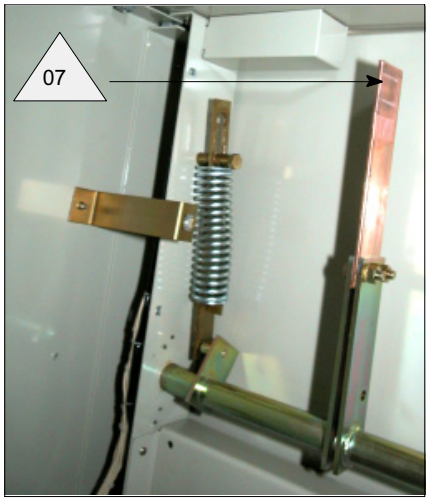
Apply the ”General Safety Instructions booklet for Electrical Applications” and the particular recommendations for the network concerned for locking-out operations.	Greases: (see § 2.5)	Duration: 1 hour per functional unit



■ Joints, sliding joints and toothed pinions.



■ Joints and sliding joints.



■ Knives of the earthing switch.

10.7 Corrective maintenance of the functional units

CORRECTIVE MAINTENANCE		Levels		
Replacements or modifications		1	2	3
Replacement of a voltage transformer fuse	[see § 10.8]	-	X	X
Replacement of an internal element (insulator, capacitive divider, etc.)	[see § 10.9]	-	X	X

10.8 Replacement of a voltage transformer fuse

Intervention	Duration	Busbars	Cables	Circuit breaker	Earthing switch
Normale	1 h	energised	energised	closed	open
Possible	1 h	energised	energised	closed	opent

To have access to the fuses, please refer to the instructions given in § 5.8.

Do not forget to remove the ”visual indicator covers” from the new fuses.

10.9 Replacement of an internal element (insulator, capacitive divider, etc.)

In the ”High Voltage cables” compartment

Intervention	Duration	Busbars	Cables	Circuit breaker	Earthing switch
Normale	2 h	de-energised	de-energised	open & unplugged	open
Possible	2 h	energised	de-energised	open & unplugged	open

In the ”busbar” compartment

Intervention	Duration	Busbars	Cables	Circuit breaker	Earthing switch
Normale	2 h	de-energised	de-energised	open & unplugged	closed

The replacement of a part is generally due to an accidental deterioration. If this is the case, the intervention of an Schneider Electric technician is advisable in order to:
- replace the part in accordance with the relevant procedure(s),
- obtain the guarantee connected with the carrying out of the service,
- determine the origin of the failure.

11 Spare parts

11.1 The spare part

Describes a part that is designed to replace a corresponding one with a view to re-establishing the original function.

NOTICE

The replacement of these parts can only be carried out by an approved person authorised and trained for this operation.

NOTICE

For an explanation of the levels of maintenance, please refer to § 10.1.

Programmed replacement	Denomination	Replacement every	Levels 1	2	3
This concerns wearing parts, designed to be replaced after a predetermined number of uses. Use: Maintenance stock, necessary for optimum maintenance procedures every 6 years.	Fans (by 3)	30,000 h energized	X	X	X
	Undervoltage coil	40,000 h energized	X	X	X
	HV fuses (by 3)	20 years	X	X	X
	Heating element	-	X	X	X

Non-Programmed replacement	Denomination	Levels 1	2	3
Designates spare parts, the replacement of which intervenes following particular conditions in use. Use: Parts that are changed during a corrective maintenance operation, outside the scope of normal preventive maintenance actions.	Tertiary resistor	X	X	X
	Luminous indicator	X	X	X

Exceptional replacement	Denomination	Levels 1	2	3
Describes the spare parts or assemblies whose foreseeable service life is at least equal to that of the equipment. Use: Spare parts or sub-assemblies conserved in a safety stock.	Moving part micro-switch position	X	X	X
	Withdrawing crank handle	X	X	X
	Operating lever for the earthing switch	X	X	X
	Operating lever for circuit breaker	X	X	X
	Moving part (circuit breaker)	X	X	X
	Current transformers	-	X	X
	Voltage transformers	-	X	X
	Lightning/Surge arrester	-	X	X

11.2 Identification of the equipment (see § 5.4)

NOTICE

For all orders for spare parts, it is necessary to enclose the equipment characteristics form.

11.3 Storage conditions

The components should be stored away from dust, humidity or the sun. In order to facilitate the search, they must be marked by the Schneider Electric reference number.

Certain components are fragile, they should preferably be stored in their original packaging.

11.4 Maintenance Consumables

Designates the products necessary for maintenance (see § 2.5).

NOTICE

For all orders for spare parts, it is necessary to enclose the material characteristics data sheet.

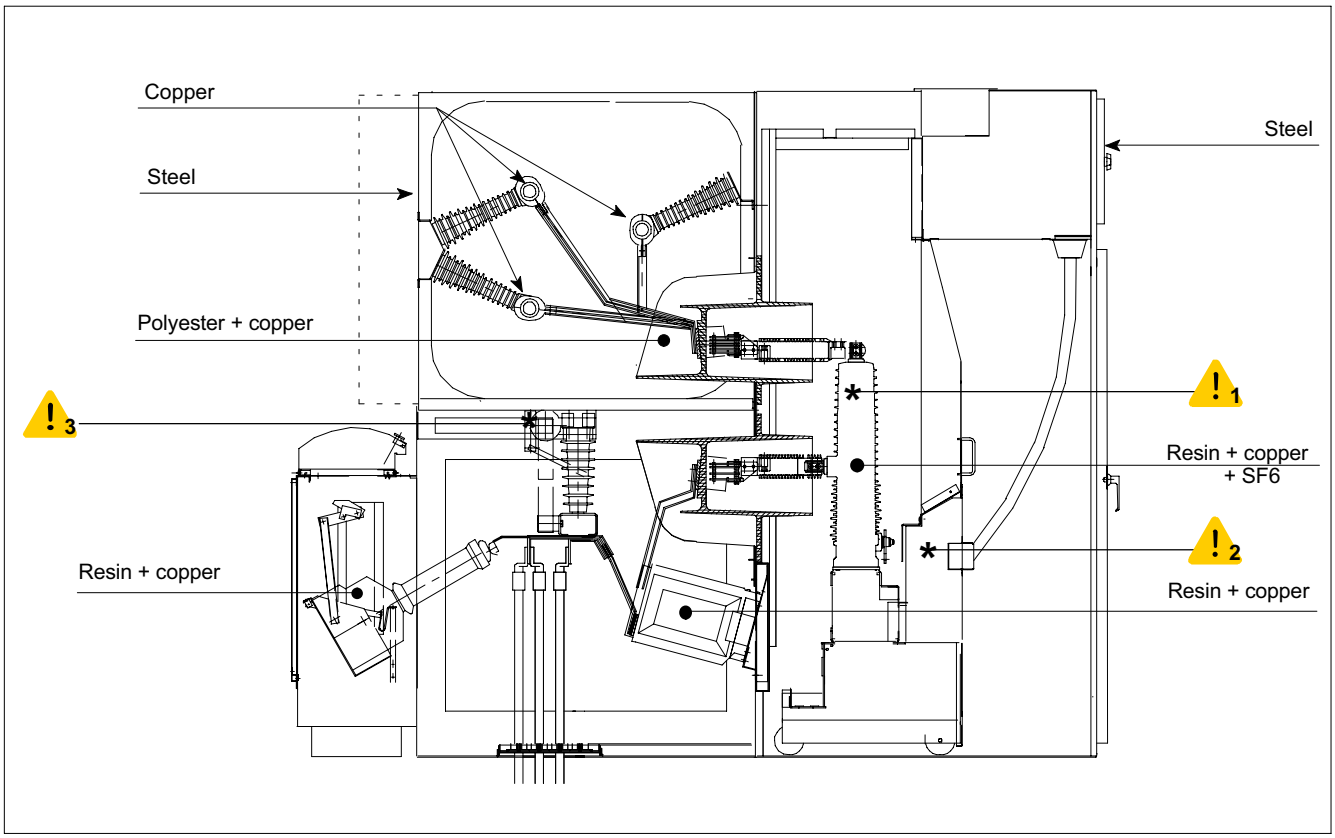
1 – Technical characteristics of the device identification plate (type, reference, order number, serial number, year of construction, etc.)

2 – Switchboard nameplate.
These indications are indispensable in order to identify the parts, in relation to a highly varied range of products.

12 End of the equipment service life

12.1 Valorization of the equipment

Schneider Electric functional units are composed of recyclable elements.



12.2 Safety instructions

1 Do not dismantle the mechanical control mechanism springs without the releasing device.

2 Do not open the poles without first having recovered the SF6 gas using the appropriate tools.

3 Do not dismantle the earthing switch's springs without the releasing device.

12.3 Dismantling of the equipment

Consult Schneider Electric for all types of decommissioning work.

Remove all electrical equipment (coils, motors, etc.).

On disassembly, the materials must be sorted and sent on via the appropriate recycling channels.

CAUTION

The recovery of SF6 gas, and the opening of the switches or the poles can only be carried out by Schneider Electric.

13 Notes

If you have any comments on the use of this document or on the use of the equipment and services that are described in it, please send us your remarks, suggestions and wishes to:

Schneider Electric Service Technique BP 84019 F-71040 Mâcon Cedex 9 - FRANCE

Fax: 33 (0)3 85 29 36 36

© 2011 Schneider Electric - All rights reserved

Schneider Electric Energy France
35, rue Joseph Monier
CS 30323
F - 92506 Rueil-Malmaison Cedex

RCS Nanterre 511 746 356
Capital social 6 909 620 €
www.schneider-electric.com

Due to possible changes in standards and equipment, the characteristics and images shown in this document can only be confirmed by contacting our departments.

Publication: Schneider Electric
Design: Schneider Electric

03-2011

AMTNoT013-02 revision: 04